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"Her meadows fountain-fed, her valleys bright, Her sea-gulls white."

(Hywel Ab Owain, Prince of Gwygnedd) (Trans. A. P. Graves)

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The Two Loads

FOR more than a score of years after Dr. John Hopkinson had laid down the basis of electricity supply tariffs it was still necessary to justify the quoting of low rates for power. It was still being argued, even by responsible persons, that because the lighting consumer paid at a higher rate he was subsidising the power consumer.

The mischief of this view was that it checked the application of electricity to industrial processes. However, after the growth of the power load had enabled generation to be carried out on a scale that warranted a lowering of prices for lighting a natural reaction followed, and the statutory requirement to supply small residential loads was often regarded as a liability rather than an asset.

Possibly a relic of this attitude is to be found in the suspicion which lingers here and there that low domestic rates are due more to popular clamour than to economic considerations, and are given at the expense of the power user. This has persisted even though the average domestic installation has been enlarged from a few lamps of low individual candle-power to relatively heavy apparatus, and this class of consumer now absorbs more than one-third of the output of public supply undertakings.

The importance of the industrial load cannot be over-estimated. It still takes well over half the electricity generated, and provides the wherewithal for the worker to enjoy his electrified home; moreover, it offers the most promising field for new uses of electricity and also for engineering skill in seeking out fresh applications.

That power usually forms the backbone of an undertaking's load does not make the domestic load in any sense parasitic. Support to this view is given by the Statement of Tariffs in force on January 1st in London and the Home Counties (the publication of which was referred to in a recent issue). In this area is consumed a quarter of the electricity produced in Great Britain, and the domestic exceeds the industrial consumption which is a reversal of the usual conditions.

Comparing those undertakings in which the kWh sold for domestic purposes is over two-thirds of the total with those in which the power output is of similar proportions, we find that the first group is in just as healthy a condition as the other. The type of load predominating is not influenced by tariffs, as charges for power are no higher as a whole, and in some cases are less, in the mainly domestic undertakings, while their load factors and kWh sold per head are little behind, and in a few individual cases better than, those in which power preponderates.

The two loads are of parallel, and not divergent, interest. The intensive cultivation of the one is far from being inimical to the full exploitation of the other. Indeed, the association of the two provides the valuable diversity of a mixed load to the benefit of both groups, while the stability of the domestic load assists in keeping prices for power at a low level in adverse trade conditions.

Pulverised-Fuel Plant

STEAM-RAISING by the use of pulverised coal has not made the progress expected by some of its early advocates. The chief reason for the somewhat limited scope found for it is, no doubt, the great advance made during the past decade in the design of mechanical stokers, including the width of grate now practicable for the largest boilers in the country. Another deterrent is the greater importance now attached to freedom from grit emission, since a pulverised-fuel furnace may discharge seven times as much ash to the chimney from a given quantity of coal as would a stoker-fired unit. A proportion of the grit is often mineral matter, and this can be removed from the fuel; the balance can be rendered innocuous by precipitation. The main objection to p.-f. firing is generally economic, as often a good case can be made for it on engineering grounds. The latter are discussed in an article that appears in this issue. Much of the

trouble in the past has been due to the installation of unsuitable extraction plant, but the experience now available should enable a true balance to be struck between technical and economic considerations.

Domestic Refrigeration

The past week has not been a propitious one for the inculcation of the refrigeration idea. Nevertheless, though spring may be far behind, warmer days are coming and electricity supply authorities should be prepared for them. The refrigerator provides a well-spread load during the lean season of the year and should therefore be developed. That it can be developed, even in this country, has been proved by the gas industry and it would be foolish for electricity supply undertakings to allow their rivals literally to freeze them out of the domestic refrigerator business. We therefore commend to their attention the article dealing with the latest developments in the refrigerator field which appears on page 568.

Falsified Figures

The United States is often held up as an example of a country where electricity is used to an extent unheard of elsewhere. From time to time colossal figures are published of the numbers of cookers, vacuum cleaners, refrigerators, irons, and washing machines in use in American homes. An interesting sidelight is thrown on these figures in the March *Bulletin* of the Edison Electric Institute. In the course of a survey of domestic electricity consumption it is said that several factors contribute to an apparent exaggeration of the use of domestic service. One of these is the assumption that appliances are practically immortal. "Many of the figures commonly accepted cannot be justified except by assuming that these appliances last at least fifteen years without replacement. . . . Such computations lead to the assumption of a large increase in connected load and to a cruel delusion as to the size of the hypothetical market for electricity." Another assumption is that the appliances are in regular use, when, in fact, many of them are not. We wonder if the figures published by British electricity supply authorities are always free from the overweight of long-dead and unused appliances. It would be interesting to know what practice is followed by some of our leading undertakings in calculating or estimating their connected load.

Stagnation in the States?

Another very strange circumstance is revealed in the Institute's survey. Figures showing the growth of electricity consumption for domestic purposes during the past nine years are set out and on the face of things they seem to be fairly satisfactory. The average rose from 443 to 673 kWh during the period—an increase of 52 per cent., and yet an analysis reveals that this increase was due almost entirely to the greater consumption of two classes of appliance—refrigerators and radio sets. Cooking, heating, water heating and lighting, which are providing a rapidly increasing load to our supply undertakings, seem to have made little headway. It cannot be argued that this was because "saturation point" was reached in the United States many years ago, for in some respects they are behind us. Among the more than 20 million consumers there were only 320,000 water heaters and 1,135,000 ranges, while electric "space heating" also appeared to be under-developed.

Among So Many

During a visit to a large modern electrical factory a few days ago we caught sight of numerous notices that the management considered it advisable to put up in conspicuous positions. These prohibited employés from attempting to carry out work on or remedying defects in electrical apparatus, and instructed them to inform one of the electricians engaged for such duties. Householders, although not under orders, should take the advice given by the St. Pancras coroner a few days ago that unskilled people should not tamper with or make additions to electrical installations. In the case in question, the original installation was sound, but an amateur extension had been made in the bathroom, where an unearthed bowl fire was connected. But how is the householder to be sure that an outside electrician has the requisite qualifications? In our leader last week we showed that the Electrical Contractors' Association and the National Register, taken together, represented only 2,400 contractors. These do not go very far among the seven million consumers of electricity who wish to secure the services of reliable experts.

The Liffey Project

It is reported from Dublin that official approval has now been given to one of the schemes propounded for the employment of the River Liffey to produce electricity. The cost of the complete scheme is expected to be in the region of £1,200,000, but as it is a combined undertaking, one feature being the provision of a supply of water to Dublin, this does not represent the electrical expenditure. It is stated that the scheme will provide the Electricity Supply Board with more power than it will really need for ten years and consequently financial assistance is to be provided by the Dublin Corporation and the Government. The economics of the scheme is further complicated by the fact that it is a part of the Government's policy to render the Free State as independent of imports as possible. On this account a strict comparison with coal-produced energy cannot be made.

The Human Dynamo

There is nothing new in the idea that our activities are due to the working of an elaborate electrical system in our bodies, but Professor E. J. Cohn, of Harvard Medical School, appears to have given this view a firmer scientific basis. According to *The Times*, he has found that the ends of the large molecules composing proteins (the chief constituent of protoplasm) are oppositely charged, and that, for some as yet unascertained reason, the positive end may lose its charge. The negative end is then attracted to the positive of the next molecule and a current is set up along a chain of molecules until it is finally discharged in muscular action. Glandular secretion and the conduction of nervous impulses are also associated with similar electrical charges, results varying with the size, shape, and the number and location of charges on the surface of the molecules. Investigations are evidently in the embryo stage, but if pursued they may lead to a clearer understanding of the inter-relation of mind and body.

Explaining the Wiring Regulations

The nature of the phraseology used in the I.E.E. Wiring Regulations is intended to provide for the interpretation of any doubtful point that might conceivably arise. The consequent need for almost meticulous expression does not permit of their being couched in terms that are easily understood by operatives engaged in the wiring of buildings, or, indeed, by many with higher academic qualifications. For these we have "The Employees' Guide" of the Association of Supervising Electrical Engineers, which does much to clarify their meaning. In the United States they go much further, books being published which expound the National Code and give possible interpretations of its many sections at great length. Such books are often used as instruction-class text-books, a procedure which appears to have much to recommend it, for although our contracting associations desire compliance with the I.E.E. Regulations little is done of a practical nature to stimulate the study of these by men engaged on installation work, or to impart reasons for rigorous enactment. There is room, at any rate, for the kind of explanation given by the Senior Electrical Inspector of Factories in his Memorandum on the Electricity Regulations which apply to industrial conditions.

The New L.M.S. Laboratory at Derby

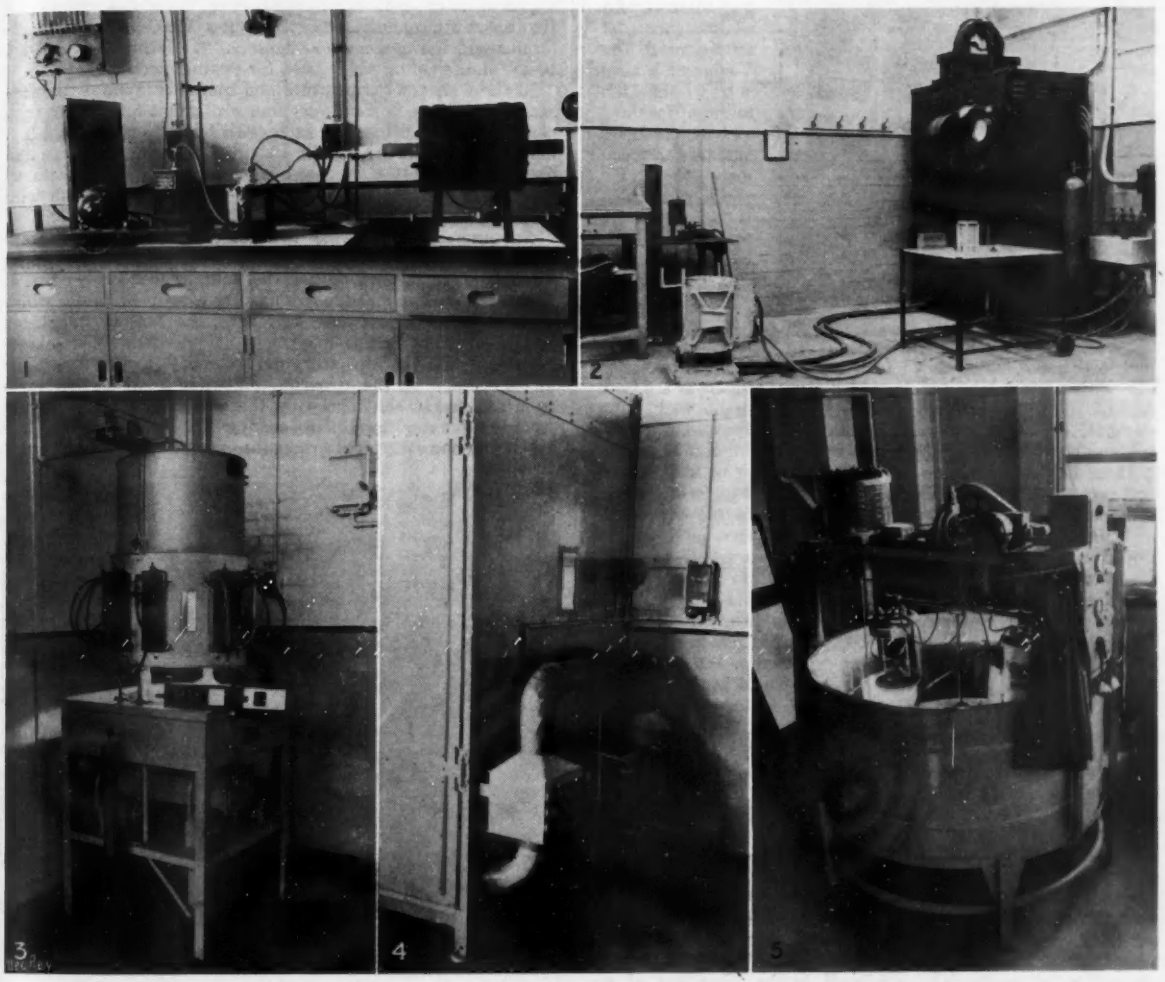
A description of the electrical devices for testing materials

To carry out tests in connection with the large variety of materials which it uses, ranging from metals to cotton waste, the L.M.S. Railway Co. recently established an extensive and well-equipped laboratory at Derby. Broadly, it is divided into four sections, namely, engineering, metallurgy, textile and paint, although these are co-ordinated to a certain extent. We should say that the outstanding feature of the laboratory is conditioning; not merely air conditioning, but the reproduction precisely of temperature (air and water), sunlight and humidity. For instance, in the textile section there is a room with double doors and screened windows in which constant temperature and humidity are maintained. Supplementary standard "Magnet" tubular heaters are thermostatically controlled while the humidity is governed by circulating the air through calcium chloride or wet coke. These drying and humidifying media are housed in separate sections of a "tower" within the room, each fitted with a circulating fan, and the fan motors are controlled by relay-tilted mercury switches on a Foster control board specially designed to eliminate hammering of the relays.

A rotary switch driven by a Warren synchronous motor ensures that once a relay is switched on it remains so until the end of a half-minute period. Final control is by a "Services" hair instrument, and if the corresponding contact of this instrument has opened by the end of the half-minute period, the mercury switch will tilt to the "off" position; if not, the switch will remain "on" until the end of that period in which the hair contacts open. The expansion or contraction of the hair in the control instrument, due, respectively, to an increase or decrease of humidity, permits lateral movement of a vertical straight spring and, in turn, operation of the contacts at the end of the spring.

The "Fugitometer" apparatus produced by Messrs. Kelvin Bottomley & Baird, Ltd., is used for testing the fastness to light of dyed fabrics. Specimens are exposed in the slide holders of switch boxes around the outside of the cylindrical body to light from an arc lamp inside the cylinder. One specially filled carbon electrode results in a fairly close approximation to natural sunlight. A motor fan underneath blows air through a salt solution and up into the apparatus so as to produce a humid atmosphere next to the specimens. Withdrawal of a slide permits the comparison of exposed and unexposed portions.

There is a cylindrical conditioning oven with variable-resistance elements in the bottom, over which a wire mesh container is suspended. Element tappings are brought out to the studs of a face-plate type regulator. Working temperatures up to 110 deg. C. are permitted, and complete drying of materials is effected.



Some of the Apparatus at the L.M.S. Laboratory

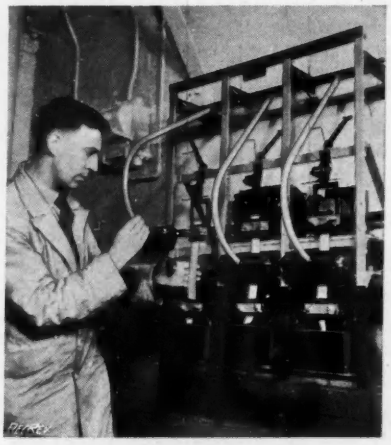
1. The "Hyvac" pump and tube furnace as in test. 2. A high-frequency furnace, showing the large and small heating "coils." 3. The "Fugitometer"; one switch box has been removed and the pattern holder partly withdrawn. 4. Constant temperature and humidity cabinet in the paint section showing the element "boxes." 5. The "Weatherometer."

In the paint section constant temperature and humidity are produced and maintained in a steel cabinet, but the control is effected outside the cabinet. Air and water are conveyed into the central of three "boxes" on one side of the cabinet, the water through internal coils and the air around the coils. Heating elements in the box warm both the air and the water, which are simultaneously fed into a second box, the water being sprayed. Saturated air is passed to a third box in which elements raise its temperature and consequently lower its degree of saturation or humidity to the point required within the chamber into which it is immediately passed. A Drayton thermostat in the chamber controls the elements in the third box, and a similar thermostat in the air-pipe connection between the second and third boxes controls the elements in the first. Drying and ageing conditions are thus obtained within the cabinet for specimen films of paint.

A "Weatherometer" in this section affords the equivalent of five years' natural exposure in five weeks. Specimens are housed in racks and exposed to "sunlight" and "rain"

around the inside of a cylindrical metal body, two arc lamps and two water sprays being revolved on a common frame by a motor. A maximum loading of six kW is required to produce an exposure effect of the intensity mentioned.

We also saw in the paint section a constant-temperature water bath in which numerous tests (*e.g.* viscosity) can be carried out. Its special appeal to the engineering mind is its high degree of accuracy (to 0.2 deg. C.) from the simplest operating components. With variation of the water temperature an immersed column of mercury rises or falls and, on the float-switch principle, operates the heater switch. The heater consists of one or more lamps partially in the water.



Testing textiles for wear

An ingenious adaptation of a milling machine by the metallurgical section permits the wear testing of bearing metals with a measure of conditioning. The V-edge of a steel wheel on the milling machine arbor revolves against a specimen bearing metal pad which is subjected to upward load by weight and lever. The specimen is placed in a bakelite bowl and flooded with oil, the bowl being bolted down to the piston top by an asbestos nut with a steel tube top to which the specimen is secured. Around the asbestos nut is a small variable-resistance heating element, and the combined result is the equivalent of the rubbing effect due to a wheel on a train travelling at 43 m.p.h.

There is also a machine for testing the wear of metals (rail and tyre steels) in unlubricated contact. The upper and lower of a pair of wheels represent, respectively, a railway wheel and the track rail. A spring supported "carriage" on the upper wheel axle can be weighted from the top and power is transmitted from the upper carriage wheel to the lower rail wheel to imitate tractive effort. A 15-h.p. d.c. motor which drives the upper wheel runs at from 0 to 1,680 r.p.m. under conditions (44 to 440 V) set by a C.P. motor-generator with a 7½-h.p., 1,500-r.p.m. driving unit. The m.g. set has Ward Leonard control. Power from the rail wheel is absorbed by a 9-kW generator (0 to 800 r.p.m. and 44 to 440 V) and is thereby fed back electrically to the carriage-wheel driving motor through common bus-bars. Wheel slip and de-railing forces can be measured, and the carriage can be pushed laterally and also set askew of the track.

In a wheel wear-testing machine two 2-in. dia. annular specimens ½-in. thick can be rotated under forced peripheral contact at varying speeds and degrees of surface slip. A 3-h.p. incorporated vertical motor permits specimen speeds of from 5 to 250 r.p.m. and loads up to 500 lb. under the influence of an English Electric m.g. set with Ward Leonard control. Other items of electrical interest in the engineering shops are a Haigh electro-magnetic fatigue testing machine in which the specimen is subjected to the vibrations of an armature between and under the influence of two sets of coils excited separately from the two phases of a two-phase m.g. set, and a very large Wholer machine for fatigue testing press fits such as of crank shafts.

The metallurgy section, of course, works in close association with the engineering section. Leads running from the pyrometry to various other rooms permit a Tinsley thermo-electric potentiometer to be used to check pyrometers and to find the correct heat-treatment and hardening temperatures for metals treated in other parts of the building. The operating principle is to balance an adjustable local e.m.f. against the thermo-couple e.m.f. until the Cambridge mirror galvanometer gives no deflection. From a calibration chart the e.m.f. value is then interpreted in terms of temperature. For instance, 9.16 mV equals 1,010 deg. C.

A "Hyvac" pump in this room is used for pyrometer tests under vacuum. From left to right in the illustration of this apparatus on the previous page the major components are the "Hyvac" pump, the pressure gauge with spark gap and a tube furnace with a sealed silica specimen tube complete with the pyrometer. We saw a small furnace fitted with "Silit" elements which is used for melting such metals as copper and cast-iron and which will produce up to 1,350 deg. C. In the chemical laboratory there are a thermostatically controlled Hearson drying oven (300 deg. C.) which is used for drying out moulding sand test pieces, a motor-driven bottle shaker in which moulding sand is shaken up with caustic soda to deflocculate the clay, and a 600-W ignition muffle furnace.

For taking photomicrographs there is in the metallography room a large Vickers projection microscope with two alternative light sources—a d.c. arc lamp and a "Pointolite" lamp. An excellent furnace installation embraces a 35-kVA h.f. furnace (Electric Furnace Co., Ltd.) for producing up to 18-lb. experimental steel ingots; a 9-kVA (1,350 deg. C.) furnace with rod elements in the roof, and a 14-kVA 1,000 deg. C.) furnace with wall spiral elements both produced by the General Electric Co., Ltd., and used for heat-treatment work; a 5-kVA (700 deg. C.) "Birlec" tempering furnace with a fan in the base for circulating air through the charge; and a 2-kW Gallenkamp tilting furnace with the element wound round the vertical silica container for general work. Supply for the high-frequency unit is obtained from spark-gap equipment (hydrogen atmosphere), incorporating a 60,000-V step-up transformer and the necessary condensers. A Metropolitan-Vickers 10-kW d.c. welding set is used for testing electrodes.

In the constant temperature and humidity room of the textile section there is some very fine equipment for dealing with cloth, yarn and cords. In each cloth testing machine a 1-h.p. motor with a belt drive pulls a strip of cloth between free and fixed jaws against a weighted pressure gauge, in one case up to 1,000 lb. pull. Linen and cotton increase in strength with added moisture content but wool and worsted weaken.

An interesting machine engaged on wear-testing work consists essentially of three inverted swan-neck arms hinged at the top, each carrying a carborundum-faced rubber pad at the bottom. Each pad bears against a strip of fabric which is held vertically between two jaws, the bottom one being weighted. Side to side movement at 100 strokes per minute is imparted to the top jaws simultaneously, so that the fabric strips rub against the carborundum, while a torsion movement is introduced in the fabrics by the weighted bottoms. There is an automatic movement counter on each top jaw, and when any one strip wears right through the released bottom of

Testing metals in unlubricated contact

the arm swings in and puts the counter out of action by operating a telephone-jack connection. When the third strip wears through the swinging arm stops the driving motor.

In the paint section, in addition to a shaking machine for the extraction of soluble lead compounds, there are a muffle for the ignition of precipitates, a heated water bath for the recovery of solvents with boiling points below 60 deg. C., and for the extraction of oily matter from pigments of low density (carbon blacks), and centrifuges for separating pigments from vehicles (*e.g.*, oils). We saw some interesting examples of the numerous uses which are being found for the gramophone-type motor. In an extensometer such a motor revolves a threaded bush about a screwed rod with which it is engaged, so that the rod travels and thereby breaks a paint film.

Throughout the laboratory there are switch plug wall outlets for both d.c. and a.c. and for the many non-portable small motors Allen West combined switch and starter units with start and stop push-buttons are installed. A 40-kW Hewittic rectifier with grid controls affords d.c. for the biulding.

Our thanks are due to the L.M.S. Railway Co. for permission to visit the laboratory and to take photographs, and to the research staff from whom we received much assistance.

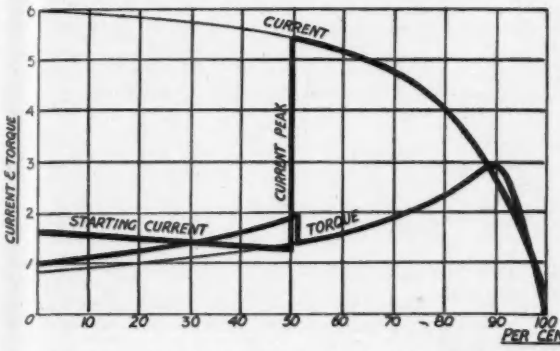
Repeated Automatic Starting. By R. Davies

Characteristics of various methods of accelerating motors

THE increasing use of automatic motor acceleration for frequent starting duty is creating a demand for smoother control and smaller current peaks than can be provided by the normal contactor starter. Further, in view of the frequency of operation the mechanical design of the complete equipment requires more careful consideration to enable it to withstand the effect of continual changes of torque.

Until quite recently the usual method adopted for the automatic control of a d.c. motor was by means of contactors controlled by a master timing device in the case of large machines; a multi-step solenoid starter combined with a master timing device for medium size motors; and two-step back-e.m.f. or time element control for small machines, say, up to 5 or 7½ h.p.

Similarly, for the automatic acceleration of a.c. motors con-



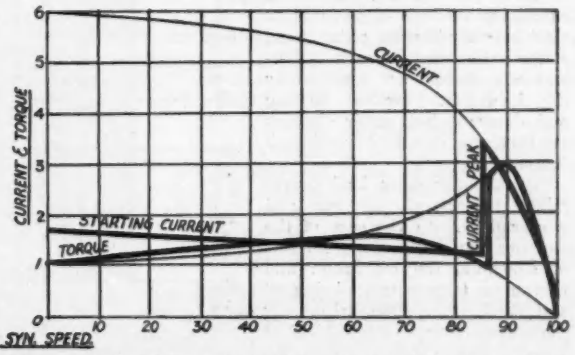


Fig. 1.—Curve of automatic contactor type stator/rotor starter with one accelerating contactor (note current peak when resistance is short-circuited). Fig. 2 (right): Speed-torque curves with eddy current starter short-circuited at 85 per cent. of synchronous speed

tactor type starters have been employed which accelerate the motor in two or more steps according to the type of machine, except in the case of direct-on starting which, of course, allows the motor to accelerate in one step.

Whether a star-delta, auto-transformer, or primary resistance starter is used for a squirrel-cage motor and a contactor-type stator/rotor starter for a slip-ring machine, there is the same disadvantage when frequent duty is required. In the case of slip-ring motors up to 25 h.p. it is standard practice to provide only one rotor accelerating contactor, arranged to cut out the starting resistance when the motor has reached approximately half speed, at which period the motor draws a current from the line equal to the short-circuit current of the motor corresponding to this position as referred to the speed-current curve, which condition is very little better than direct-on starting. Further, there is a severe "kick" in the torque curve which is repeated each time the motor is started and which, in certain applications, may have serious consequences, or at any rate impose a considerable strain on the mechanical equipment.

To increase the number of starting steps in a contactor type starter for a slip-ring motor means providing a contactor for each additional step, which would necessitate a large number of accelerating contactors to bring the motor up to full speed smoothly. This method has proved unduly costly and alternative schemes have been substituted which enable the motor to accelerate smoothly, and without excessive peak current or serious torque disturbance.

Stepless Starting

The ideal method of starting a motor is by means of a liquid rheostat, but this type is impracticable for a number of reasons, particularly when frequent operation is necessary. The nearest approach to the liquid starter for a.c. motors is the variable impedance method for squirrel cage machines and some form of eddy current starter for slip-ring motors. Both these methods enable the motor to be accelerated without any violent disturbance of either the current or torque, except possibly a slight kick when finally short-circuiting the eddy current starter, and which has no appreciable effect.

These three methods provide stepless starting and allow smooth acceleration without imposing any strain either on the supply or the mechanical equipment. Another method includes a pilot motor operated multi-finger contact starter and is applicable to both a.c. and d.c. systems. If the pilot motor is connected directly across the main supply it will cut out the starting resistance in a certain specified time, so providing time-element control.

On the other hand, if in the d.c. case the pilot motor has two field windings, one connected directly across the line and the other across the starting resistance, the field strength will vary between maximum and minimum values governed by the voltage drop across the resistance which, in turn, will depend upon the value of the starting current. Thus the speed of the pilot motor will be partly determined by the load current and partly by the limiting speed field winding; with the result that the starting resistance is cut out in the shortest possible time, consistent with the nature of the load. This ensures smooth acceleration, which is completely devoid of any undue current peak disturbance.

To provide an equivalent method of starting for slip-ring motors a three-phase pilot motor is connected across the secondary terminals so that its speed will be determined by the secondary frequency. While this arrangement functions in a different manner from that described for a d.c. motor, it will respond to the characteristics of the induction motor in an admirable manner.

At starting, the secondary frequency is high and consequently the pilot motor runs fast; as the main motor speed increases the pilot motor speed increases; consequently, if the main motor accelerates too rapidly the pilot motor delays cutting out the following section of resistance. But if, due to the load, the motor is prevented from starting up as quickly as desired the pilot motor will cut out the following section of resistance in a shorter period, thus enabling the main motor to draw more current for accelerating purposes, and so on until the motor is brought up to speed with the minimum line disturbance.

Possible Revolution in Control Gear Design

These methods of pilot-motor operated starters probably offer a satisfactory solution to the difficulties met with in the case of contactor starters, as the latter type must be controlled by relays, which only add to the complications of automatic control and provide a source of unnecessary weakness. Fractional horse-power pilot motors of reliable design and construction are now available and, as only one unit is required independently of the number of starting steps, control is reduced to the simplest possible form.

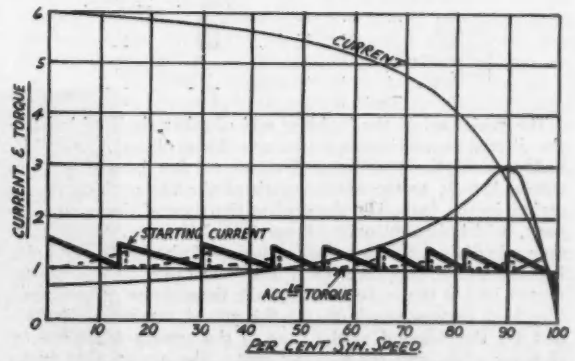


Fig. 3.—Pilot motor-operated rotor starter curve (multi-slip type)

It is within the bounds of possibility that the proved reliability of the pilot motor may mean a revolution in the design of automatic control gear for motors which are required to start frequently, in which event such equipment as that described will be of material assistance in this progressive development.

The Load Incidence of High-class Flats. By I. B. Walker

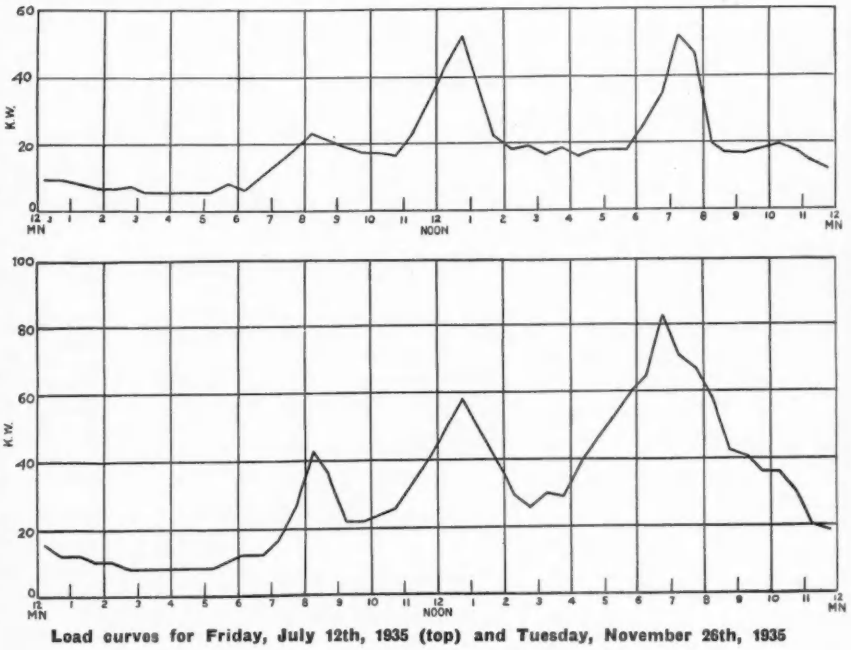
Data for typical summer and winter days

INFORMATION has frequently appeared in these pages regarding the demand made on electricity supply undertakings by housing estates, both all-electric and otherwise, and middle-class properties generally, but it is found that similar data regarding blocks of high-class flats is less readily available.

The following particulars, which apply to a block of fifty-seven modern flats in the Rutland Gate district of Kensington, will enable the value of the load imposed by this class of residential consumers to be appreciated.

The flats vary in size, having from three to five rooms, exclusive of the kitchen and usual offices, and are let at rentals of from £275 to £400 per annum. Provision exists for the use of gas and/or electricity for heating and cooking at the option of the tenants. Electric refrigerators are supplied by the landlords. Central heating and domestic hot water supplies are furnished by an oil-fired installation.

The accompanying load curves relate to typical summer and winter days. In the case of the summer day there were 4.6 hrs. of sunshine, the maximum and minimum temperatures being 81 and 63 deg. F. The half-hourly maximum demand was 52 kW at 1 p.m. and 7 p.m. During the winter day there were 1.8 hrs. of sunshine, no rain falling. The maximum and minimum temperatures were 51 and 32 deg F., and the half-hourly maximum demand was 83 kW at 7 p.m. The connected load on both days was 625 kW. The curves are derived from a recording summation ammeter of special design. Three current transformers, the cores of which can be easily unbolted, are slipped over the three single-phase, lead-covered cables between the low-voltage side of the power transformer and the bus-bars in the basement switchroom. The secondary output from each current transformer is rectified, and fed to a moving-coil armature. A pointer attached to this armature makes a mark on a treated chart approximately every two seconds. The chart is revolved by a synchronous clock mechanism. The instrument is also suitable for the measurement of single-phase loads, and current transformers of varying ratio can be readily introduced into any circuit.



Load curves for Friday, July 12th, 1935 (top) and Tuesday, November 26th, 1935

On the dates when these curves were taken the connected load of the block in kW was as follows:—

	Tenants.	Landlords.
Lighting	42	12
Heating	239	9
Cooking	286	—
Refrigeration	6	—
Power	—	31
Total	573	52

The peak load of the building and of other similar blocks in the district occurs in the winter months at about 7 p.m. The incidence of the maximum demand at this late hour is of special benefit as the system peak of the undertaking occurs earlier in the day. The demand at the time of the company's peak, which is continuous from 4 to 5.30 p.m., amounts to approximately 1 kW per flat, inclusive of the landlord's lighting and power supplies. Only 1 kW in every 10 kW of connected load is therefore in use at the time of the system peak. The load factors based on (a) the actual maximum demand and (b) the demand at the time of the system peak, are (a) 31.8 per cent., and (b) 49.6 per cent. The annual load factor of the undertaking is 34.5 per cent.

Of the fifty-seven flats in the building, forty-one are equipped with electric cookers; the majority of consumers are charged under a two-part tariff with a secondary charge of ½d. per kWh. The total consumption of the building for 1935, inclusive of the landlords' supply, was about 200,000 kWh. This is below the average for this class of supply, as the tenants are often out of town. The landlord's supply is given on a two-part basis with a secondary charge of ¾d. per kWh.

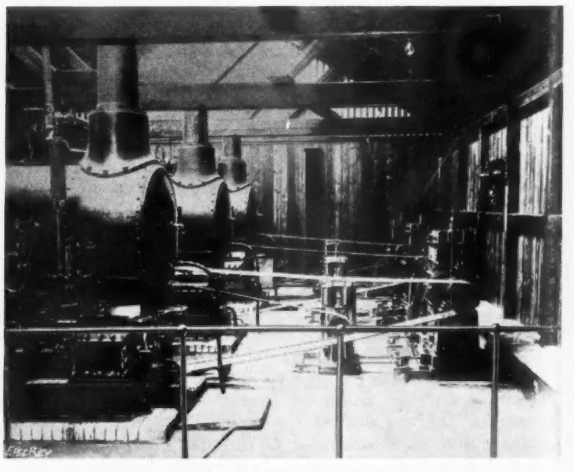
As a matter of general interest, out of five blocks of high-class flats which have recently been completed in the company's area of supply, three have been "all-electric," and in every case the landlords have assumed full responsibility for the whole of the fixed annual charge in respect of the domestic supply to the building, recovering it from their tenants by way of rent. The supply company's quarterly account to a tenant, therefore, includes only the kWh actually consumed at ½d. per kWh, plus the amount due for the hire or hire-purchase of electrical apparatus. The amount of the annual charge paid by the landlords in respect of the flats is lower than the total of individual assessments, as the charge is payable whether the flats are occupied or not.

In order to achieve these results, close contact is necessary with the architects from the commencement of the scheme of development, and negotiations are simplified if a contribution is made towards the cost of rising mains.

Generally speaking, there can be no doubt that national advertising campaigns and local propaganda are beginning to take effect. Experience has proved beyond doubt that with an active commercial organisation, proper tariffs and efficient service the major portion of the business in new or converted property can be obtained despite keen competition.

Jubilee of Tilbury Docks

The fiftieth anniversary of the opening of Tilbury Docks in April, 1886, calls to mind the electric lighting plant which was installed there at that early date. The plant was grouped in two stations. In the north station power was provided by two Fowler engines of 50 h.p. (nominal), driving Crompton dynamos. Our picture shows the three Marshall engines which drove the dynamos in the south station, providing light for the Tilbury Hotel as well as for the docks



The Tilbury Docks South station in 1886

Showroom Window Display. By F. Jarvis

Making the most of the space available

ALTHOUGH the art of display has long been known and recognised, the technique of window display as we know it to-day has been developed only within the last thirty years. The space used for showroom windows represents the most valuable space in the building, and estimates of the worth of window space vary from 25 per cent. to 50 per cent. of the rent paid for the premises. It therefore behoves the person responsible for the showrooms to see that the windows are used in the capacity of sale-makers. Any window is worth a salary, and it is good management to appropriate a certain amount of money to maintain satisfactory window displays. Many large stores, realising the worth of attractive windows, invest upwards of 4 per cent. of sales, whilst one American stores uses $1 out of every $7 appropriated for advertising to provide and maintain window displays. Progressive departmental stores in London and the Provinces have long realised that just as people are largely judged by their appearance, so are shops judged by their windows.

An example of co-operative advertising between the West Ham Electricity Department and a local manufacturer

The recognition of the selling power of windows has led to a careful study of window construction. A good average size for a showroom window is 9 ft. high by 12 ft. long by 8 ft. deep. Reflections are one of the bugbears of display arrangements, but happily this disability can now be overcome by using the new type of reflectionless window. This window, a British invention, consists of a concave sheet of glass so designed that all reflected light from its surface falls on two dead-black baffle boards arranged one at the top and one at the bottom of the glass.

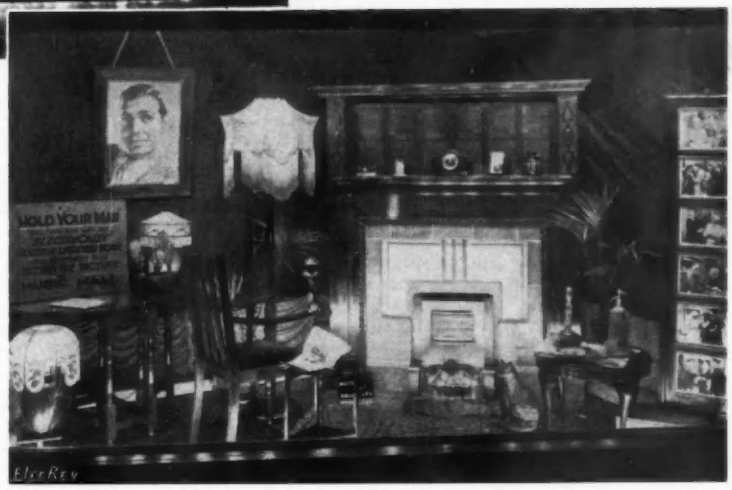
The eye of the observer, therefore, looking at the window, is completely undisturbed, and is quite unconscious of any reflection whatever on the surface of the glass. Furthermore, by its very novelty, this type of window attracts attention. Other advantages of the shadowless window are:—1. The greatly increased sales value of the window space (by enhancing the appearance of the goods displayed).

2. The absence of reflections enables the "prospect" to view the goods clearly without any sub-conscious distraction. The window itself appears to be non-existent, giving the appearance of an open display.

3. The saving in light, since every lamp in use is able to give its full illuminating value owing to the fact that the artificial lighting is not competing with the light from outside the window.

The Background

Generally speaking, there are three types of backgrounds:—(1) The open back, which allows the public to see into the showroom; (2) the semi-enclosed background that has a wall or curtain one-third up the back of the window; (3) the totally enclosed background.

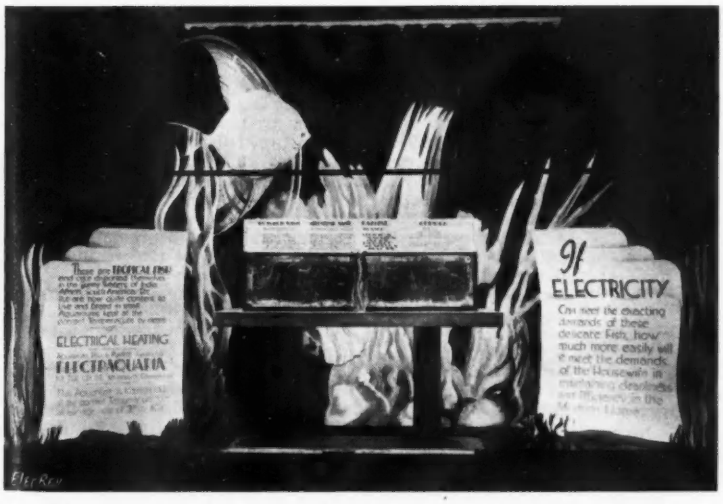


A display by the Chester Electricity Department showing a "tie-up" with a film being shown at a local cinema. Examples of electric fires, lighting fittings, &c., were also exhibited at the cinema

Most display men favour the enclosed background for the reason that the background of a window bears the same relation to the display as the scenery on a stage bears to a theatrical production. It constitutes the setting for the entire window. It is admitted that backgrounds alone cannot make an effective selling display, but when used correctly they invariably assist the effectiveness of any window, regardless of the lines displayed or the price range of the goods shown. Moreover, the public's eye is forced on to the display and cannot be distracted by any movement in the showroom, which often happens with the open and semi-enclosed types of background.

How Good Lighting Helps

Lighting and colour play big parts in attractive window displays, and it will be apparent to everybody that the Electricity Department's showroom windows must incorporate good and correct window lighting, as an example to other shops and stores in the town. The chief application of colour lighting is to create an atmosphere. It can be very effective and can considerably help the display, but it should be remembered that not more than three colours should be used in one window. The display man should always bear in mind that effects should be subordinate to the goods shown. Any coloured lighting scheme should be selected with a view to



Domestic uses of electricity are cleverly coupled with an electrically heated aquarium in this display by the County of London Electric Supply Co., Ltd.

increasing the attractiveness of the window, rather than because it is artistic. Purple is the lowest colour in point of visibility, followed by blue, then red, green, orange, and yellow. Yellow has twelve times the visibility of purple. Cool colours are greens, blues, and purples; whilst reds, oranges, and yellows are warm colours.

Crêpe paper with its wide range of colours and shades has proved of great value to display men in the last few years. Striking and attractive ensembles can be made quickly and economically. It should be borne in mind that dark colours should be used below light ones, not above.

The question of whether or not to mark prices on articles in windows has always been the subject of much discussion. It will be found nowadays, however, that the majority of window dressers agree that in order to make windows effective, prices must be shown. People dislike having to go into a showroom to inquire the price of an article, and then have to confess that it is more than they want to pay. An interesting and useful test was made some time ago in the United States. Stores A had its articles price marked; stores B had not. Of 147 people who passed stores A in ten minutes, forty-three stopped to look, twelve stayed for a minute or more, and three went into the stores. With the same test applied to stores B, three people stopped to look, but none went in.

The Use of Showcards

It is not generally known that the nerve that leads from the eye to the brain is approximately twenty-three times stronger than the nerve that leads from the ear to the brain. It is obvious therefore that showcards which tell a sales story about the goods, are, in effect, auxiliary salesmen who stay in the window and tell their message twenty-four hours every day. Good class show or talk cards are not an expense. They are an investment that will bring in dividends in the shape of customers. Moreover, the same cards can often be used several times a year. A good size of card is 18 in. by 20 in. If the cards are too small, they may be overlooked, and their message lost. If they are too large the attention is automatically diverted from the article to be sold to the card itself.

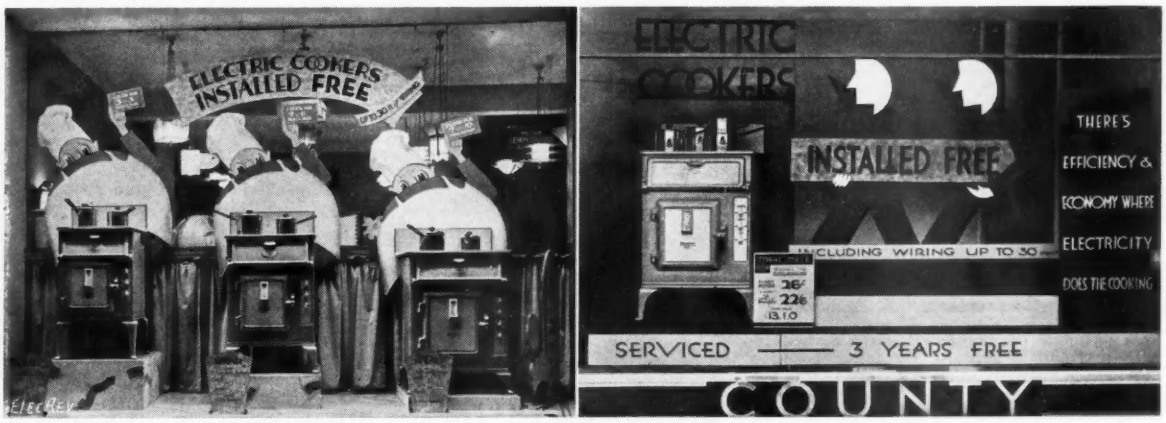
Wherever possible the cards should be placed as close to the articles to which they refer as they can, without injuring the harmonious effect of the window. Placing the cards in the extreme front of the window close to the glass is a mistake and detracts from the effort of the window as a whole. The card should tell the story which the display is intended to illustrate, by the use of either picture, text, or both. The card must be made to harmonise in colour with the goods displayed, by the use of companion colours and blending tones.

In most undertakings the showroom or sales superintendent is responsible, among other things, for window display and all advertising. He therefore has an excellent opportunity of "gearing" his window displays to press advertisements or announcements. The live window display man can always find innumerable ideas for his windows. Old slogans and catch-phrases can be turned to good advantage, whilst the titles of many popular songs and sound films are admirably suited for window "tie-ups." In the latter case, in return for advertising the film in the showroom window, the manager of the local cinema will often reciprocate by permitting a display of electrical appliances in the entrance hall or lounge of the cinema. Topical sporting events can always be turned to good advantage by the ingenious display man.

Another useful idea for a series of displays is to obtain the names of, say, six local manufacturers who are using electricity for all or nearly all their processes, and to offer to lend them the window, providing that they pay for the materials required for dressing the window. In many cases they will send a window dresser who is used to handling their particular product. The undertaking should then provide a card, giving the name and address of the manufacturer of the goods, followed by a sentence such as "Made in ——— with the aid of ——— electricity." Both the manufacturer and the undertaking obtain a good measure of publicity, and goodwill is created all round.

Windows Must Sell

In the make-up of the actual display the fact that the purpose of the window is to sell should never be overlooked. At the present stage of window display development, the theory is to make each window tell a definite sales-making story. Each display should be built around some one idea or theme.



Semi-enclosed and fully enclosed background types of window display arranged by the County of London Electric Supply Co., Ltd. Notice how in the former the fittings in the main showroom distract attention from the display, while in the latter interest is focused upon the cooker

The mere showing of a fire or cooker leaves the prospective customer without much appreciation of what he sees. This is the reason for making the window display so expressive that it is sure to put its full message into the minds of the observers.

The display man will be well advised to have a space (out of the public's view) marked out and built up to the same size as his windows, so that he can make experiments and trial displays. He can then incorporate the better ideas on a rough plan for future use.

To test a window, see if it satisfactorily answers the following questions:—

(1) Does it "catch the eye?"

(2) Does it hold attention?

(3) Does it create desire to try the goods or test the service?

It is obvious that careful thought and planning are required if sales-making window displays are to be created by those responsible.

Combating Radio Interference

Apart from its architectural decorative effects the application of metals sprayed on by means of a pistol, such as that supplied by Metallisation, Ltd. (British Oxygen Co., Ltd.) is well known in engineering, particularly for combating corrosion and attack by heat. A somewhat unusual use of the process has been adopted by the General Post Office to safeguard broadcast listeners from radio interference caused by electro-medical apparatus, the suppression of which presents unusual difficulties due to the fact that the patient undergoing treatment radiates high-frequency energy from his body. It is necessary to provide a complete electrostatic screen, enclosing patient and apparatus, and to connect a filter in the supply mains. In the case of a violet-ray set it is recommended that a screening cubicle be constructed by stretching ½-in. wire netting over a wooden framework. This is the method adopted at the present time for screening, but it has now been found that, as an alternative, the walls and ceiling of a room can be screened by spraying them with zinc, and also the floor if necessary, over which linoleum would be placed. If more convenient, however, netting only could be used on the floor.

In this manner a room can afterwards be decorated in any of the usual ways, such as with wallpaper or distemper. In spite of the extremely thin metallic coating, it has been proved that the screening by this means is better than that obtained by wire mesh.

Pulverised Fuel Firing. By "Entropy"

The conditions most advantageous to its use

IT is generally believed that for normal conditions there is little difference between the results obtained by pulverised fuel firing and by mechanical stoking. Apart from isolated cases where the choice is made to please individual taste, special circumstances do, however, often give one method a definite advantage. To explain exactly when it is preferable to burn a fuel in suspension involves a consideration of local conditions, and on this account the engineer must be guided to a large extent by his own investigations. The common idea that pulverised fuel firing is more suitable than mechanical stokers for low-grade coals is true only if the term includes coals of small size, those having a high ash content and washery refuse. It should not be accepted, however, without careful investigation, that any coal coming within the above classification can be more advantageously burned in pulverised form.

Where the System is Advantageous

Coal of a dusty nature and, in particular, aspirated fines from cleaning plants are well suited to the method, since usually a good proportion is sufficiently small to preclude the necessity for pulverising. Fuels of this nature are sometimes burned on mechanical grates, but they must generally be conditioned by the addition of water and, even so, satisfactory operation can be maintained only by continuous attention. This is without doubt a case where pulverised fuel plant would show to considerable advantage, especially when there is a convenient supply of such fuel.

When a fuel has a large ash content the calorific value is correspondingly low, and pulverised fuel firing usually presents the more attractive proposition. It is customary to design a grate for a mechanical stoker and to burn a predetermined amount of solid fuel per hour per unit of area; as a consequence, the area of grate required for a given steam production increases as the calorific value falls. The disadvantage of using mechanical stokers for coal of low calorific value is the comparatively large grate area required, involving a more expensive boiler to suit the grate dimensions. With pulverised fuel, the combustion chamber is usually designed on the basis of a predetermined rate of heat release per unit volume, so that the size of the furnace and the boiler proportions for a given steam production are independent of the heating value of the fuel. A disadvantage is that where the calorific value is low the duty of the pulverising plant is greater on account of the increased amount of coal required, and that useless work is done in pulverising the ash in addition to the combustible matter, but in spite of this handicap the odds are slightly in its favour.

Washery refuse comes practically within the same category as fuels of low calorific value, the heating value of the refuse being low on account of its high moisture content, but the difficulties of its combustion on a practical scale are aggravated by the presence of a large percentage of "fines." There is also the difficulty of feeding and distributing the fuel uniformly, which automatically gives rise to a doubtful distribution of the combustion air. With pulverised fuel firing the trouble of feeding does not occur to the same extent, since the delivery is to a much smaller area and, if necessary, feeding devices such as screw flights can be conveniently installed. Once the fuel is delivered to the pulveriser, its behaviour is much the same as that of a normal coal.

Many Other Applications

The field for the advantageous application of pulverised fuel is by no means exhausted by the cases already defined; in fact, of the installations to date, it is fairly safe to say that those falling within the above category are in the minority. This indicates that pulverised coal is frequently installed for reasons other than poor quality of coal; *e.g.*, the possibility it offers of obtaining a greater steam production from a given space, or its greater suitability for some peculiarity of an otherwise good coal or for a particular load factor.

A number of coals have a consistently low ash-fusion temperature, and if regularity of supply is ensured and the units are of sufficient size to justify the expense of water-cooled walls, ash removal from the furnace in a fluid state can be considered. Such an arrangement will entail pulverised fuel firing with a furnace designed to enable the temperature near the furnace floor to be kept with an appreciable margin above the ash-fusion temperature. This method is extensively used in the United States, and to a lesser extent in Japan, and experience in those countries shows that it has proved a successful method of utilising fuels having this characteristic.

Coal having a very low ash content, and consequently high calorific value, causes some anxiety when burned on a mechanical grate on account of the absence of a protecting medium for the grate which is usually provided by the ash content. This difficulty can easily be overcome by burning the fuel on the sandwich system, that is, by introducing ash below the green coal, but this complication is avoided by burning the fuel pulverised. Such a fuel is ideal for firing in pulverised form as its behaviour when burned in suspension closely resembles that of a gas.

For exceptionally high evaporations per unit the use of pulverised fuel appears to be essential on account of the prohibitively large areas required for mechanical grates and the magnitude of the mechanical problems presented. With pulverised fuel the construction of the combustion chamber becomes the limiting factor, since any difficulties with the capacity of the pulverising plant can easily be overcome by the installation of a suitable number of units. While mechanical stokers have been able to meet satisfactorily the demands of the largest boilers installed in this country, nevertheless, the maximum evaporation obtained elsewhere from a single pulverised fuel fired unit is twice that obtained on the largest stoker-fired unit.

Benefits of Air Separation

During recent years the process of removing the pulverised coal from the grinding chamber by a current of air has been extensively and satisfactorily used. The importance of this process is due to the need for the coal to be dry after treatment. Air separation, if carried out with preheated air or a mixture of atmospheric air and furnace gas, enables the coal to be dried simultaneously with the pulverising process. This method dispenses with raw coal drying equipment in most cases, and enables the fineness of the product to be easily regulated, while the simplified layout of the plant results in lower maintenance costs. In normal steam practice air separation is universally adopted, and on this basis the methods of firing may be defined as direct, semi-direct, or the bin-and-feeder systems.

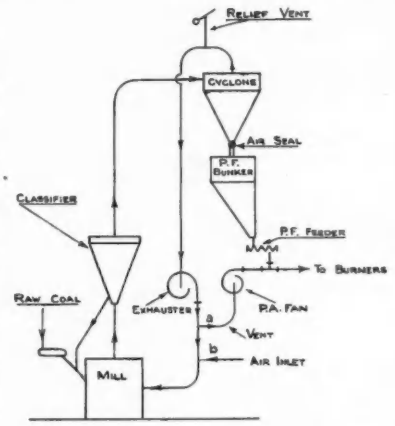
With the direct system the powdered fuel is withdrawn from the mill by a current of air created by an exhauster, and the mixture is carried direct to the burners. The chief factor governing the quantity of air discharged with the fuel to the burners, usually termed "primary air," is the amount required to lift the coal from the mill and to transport it through the classifying chamber. The ratio of the primary air to the remainder of the air for combustion, known as "secondary air," is consequently controlled by the requirements of the pulverising plant and not by combustion conditions. This factor is, however, of little importance for average bituminous coals. Since the fuel passes direct to the combustion chamber, the output must be regulated to suit the required steam production of the boiler, which results in variation in the energy absorbed by the pulverising process. The degree of variation in power consumption depends upon the type of pulveriser, but in view of the relatively low initial cost and upkeep, this slightly uneconomical feature can usually be permitted.

For coals having a difficult combustion characteristic, such as those of low volatile content, it is advisable to install a system which allows regulation of the primary and secondary air ratio to suit the combustion conditions quite independently of the demands of the milling plant. Where the necessity for such control arises, the use of either the semi-direct or the bin-and-feeder system is essential. The circuit generally employed for these systems, which are identical except in the provision of storage capacity for the pulverised fuel, is illus-

Women electrical demonstrators from all parts of the country attended the first of a series of refresher courses held last week at the headquarters of the Electrical Association for Women, Regent Street, London, W.1

trated by the diagram on this page. The current of air created by the mill exhauster carries the fuel from the mill to the classifier in which the coal of the necessary fineness is separated, the coal insufficiently pulverised being returned to the mill. The dust-laden air from the classifier passes to a cyclone, where the dust fuel is separated from the transporting air, the air being returned to the suction eye of the mill exhauster while the dust coal is passed through a valve to a storage bunker. The bunker for the bin-and-feeder system is usually of sufficient size for upwards of eight hours' supply for the boiler that it serves, but for the indirect system it is only of sufficient size to ensure a regular supply to the feeders serving the boiler. The storage capacity of the indirect system, being limited, requires the output of the mill to be regulated to suit the boiler requirements, whereas the storage capacity of the bin-and-feeder system is sufficient to render the mill output independent of the boiler consumption. The latter feature permits the mill to operate constantly at its most economical output, as to both power consumption and maintenance, since it is only necessary to ensure that the content of the bunker does not fall so low as to jeopardise the working of the feeders.

To return to the milling circuit, the discharge of the exhauster is connected to the air inlet of the mill, this connection containing an outlet at *a* through which the system is partially vented, and an inlet at *b* through which a quantity of air enters the system, equal in weight to that vented. Due to inefficiency in the working of the cyclone separator, a certain amount of dust is vented with the air at the outlet *a*, and, if the duct can be suitably arranged to prevent the dust falling out of suspension, it is advisable to connect the vent to the primary air fan; should circumstances prevent this arrangement, the vent may be constructed to discharge either to atmosphere or to a filter plant. As with direct firing, both systems are capable of drying wet coal within the mill, although, on account of the partial venting, it is advisable to limit the initial moisture content to ten per cent. and to introduce hot air or a mixture of atmospheric air and furnace gas through inlet *b*. Both the indirect and the bin-and-feeder systems render the primary air supply independent of the demands of the milling plant; although on occasion the system is vented through the primary air fan, the supply thus obtained is considerably less than the minimum quantity of primary air required to maintain the fuel in suspension in the burner pipes and is not a controlling factor.



Air regulation in a p.f. system

Types of Pulverisers

In regard to the pulveriser itself, the methods adopted to reduce the fuel to a powdered state are varied, but the machines are designed to serve the common object of performing the required duty with the minimum effort and maintenance, and with the simplest possible construction. The pulverisers usually employed in present-day power-station practice can be classified as slow, medium and high-speed. The former category embraces the tube-type machine consisting of a cylinder, partially filled with a grinding charge of small steel balls, mounted on hollow trunnions, through which the coal passes to and from the grinding zone. The drum is slowly rotated at a uniform rate, thus creating a tendency to carry the ball charge in the direction of rotation until a point is reached where the force of gravity overcomes friction, when the balls cascade to the base of the cylinder. This cascading action is continuous, and, as a consequence, the ball charge is in a constant state of agitation, which is usually increased by constructing the cylinder lining with an interrupted surface.

The coal is admitted to the cylinder through one of the hollow trunnions, and is bombarded by the ball charge until it is sufficiently reduced in size to come under the influence of the air stream passing over the ball charge, the latter being induced by an exhauster fan. The mixture of air and pulverised coal is then usually taken to an external classifier where the coal of the requisite fineness is separated from the coarser particles, the latter being returned to the grinding cylinder for further pulverisation. This type of mill is rather cumbersome, and, due to its mechanical characteristics, requires practically a constant power input irrespective of whether the cylinder contains a charge of coal in addition to the ball charge.

The mill has, however, ample compensation in other respects, in that it is practically immune from mechanical breakdown and that the efficiency of the grinding elements can be maintained with the minimum amount of attention. The ball charge can be maintained at the required level by the addition of further balls admitted with the raw coal, and the life of the grinding elements is not impaired by the admission of any tramp iron that may pass the raw-coal feeder.

Medium and High Speed

The medium-speed class embraces the ball and roller types, the principle of which is that large steel balls are pushed around the inside face of the grinding ring, or a series of large rollers makes contact with the face of the grinding ring. Coal is pulverised by passing between the ball or roller and the grinding ring, the requisite pressure between the two grinding elements being maintained by centrifugal force in the former type and by springs in the latter. These machines are mechanically balanced, and much of the driving power is absorbed in the overcoming of friction between the grinding elements.

Variations in speed and pressure can be made to suit fluctuations in output in order to obtain the most economical running. The grinding elements are so designed that the wear is uniform for a considerable period and a constant fineness of pulverisation is thus ensured, with a very small falling off in output. It is customary to separate any foreign matter from the coal before it enters the mill, as its presence in the grinding zone is liable to have serious consequences. This type of mill is generally arranged for air separation; the classifying chamber is usually an integral part of the mill, but the exhauster inducing the air flow forms a separate unit.

The high-speed series embraces a wide range of machines, which, in the main, achieve pulverisation of the material by impact between the fuel and a series of beaters revolving at high speed. The use of air to convey the pulverised product from the pulverising zone is universal, but not so the use of classifying chambers. Where classifying chambers are omitted, the fineness of the product is controlled by the clearances between the fixed and moving elements of the pulveriser, or by regulation of the air flow, the latter being in effect the equivalent of a separate classifying chamber.

As in the medium-speed machine, the moving parts are balanced and the major part of the driving power is absorbed in overcoming the resistance caused by the presence of the fuel in the grinding zone; there is, therefore, ample opportunity to adjust the power input to suit the coal output. These machines are very compact, and, as they run at a speed that is suitable for the exhauster fan, it is frequent practice to mount both the pulveriser elements and the exhauster fan runner on a common shaft. The arrangement of the pulveriser elements is such that the presence of foreign matter will cause serious damage, and, as a consequence, magnetic separation prior to the admission of the fuel to the mill is strongly advised. There is a tendency for the output and fineness of pulverisation to fall off, due to the wear of the pulverising elements, but the use of alloy steel for the construction of these components has greatly reduced this disadvantage.

The ultimate choice of equipment for a particular installation will, to a large extent, depend upon the output required, the space available and the hardness of the coal, the tendency being to use the more robust slow-speed mills for coals of an abrasive nature; the medium speed machines for large outputs with coal of normal hardness; and the high-speed machines for the lighter duties and, in particular, where the site is restricted.

A Welded Ship

Confidence in electric-welding was illustrated on April 4th, when the all-welded motorship *Franquelin* (2,087 gross tons) was launched by Messrs. Swan, Hunter & Wigham Richardson, Ltd., Wallsend, to replace the *Joseph Medill*, which disappeared last August on her first voyage across the Atlantic. The owners are the Quebec and Ontario Transportation Co., Ltd., and the new ship is intended for service on the Great Canadian Lakes. Not a single rivet has been used, all joints, plates, &c., being joined together by butt welding. The outside appearance of the ship's hull compares with the pressed steel body of a motor car. The *Franquelin* is 259 ft. long, 43 ft. 10 in. wide, and 22 ft. deep. Her engines, of the Diesel type, are to be installed by Swan Hunter's Neptune Works, and will give a speed of 9½ knots. This is the fourth welded ship built by the firm, the others being the barge *Peter G. Campbell*, the Norwegian oil tanker *Moira*, and the ill-fated *Joseph Medill*.

Diversity and Load Factor. By D. J. Bolton

The empirical basis of electricity supply tariffs

THERE are always at least two ways of tackling anything, and the subject of tariffs is no exception. One can collect all the evidence, see what tariffs there are and then try to establish a general principle to account for the facts. On the other hand, one can spin a theory and then apply this general *a priori* reasoning to construct a particular tariff. In the present instance the two methods are apt to give very discordant results. The theoretically correct tariff deduced from general principles does not at all agree with actual results as collected from existing specimens.

An analysis of costs shows that only one-eighth of the total expenses of electricity undertakings is proportional to energy, the other seven-eighths being independent of the energy and proportional to the power demand, the number of consumers and other factors. It would therefore appear that if only one charge is to be made, a flat charge for power demand would be far nearer to the costs than a flat charge for energy. The only practical tariff with any show of justice would then appear to be the Hopkinson type with a fairly high fixed charge based strictly on metered maximum demand.

When we look round at the actual tariffs the position is very different. In the first place, the flat-rate energy tariff, so far from dying out, seems as flourishing as ever, and still holds the field in a large number of areas. Secondly, in one of the two major fields of utilisation (the domestic) power demand tariffs never have been employed to any great extent and show no signs of coming in. Finally, even where the battle appears won and a two-part Hopkinson tariff is regularly put forward for industrial supplies, there seems to be something radically wrong with the ratio of the two parts.

If the whole costs of supply as detailed in the Commissioners' latest return are allocated between fixed and running on the approved lines, and divided by the corresponding kW and kWh, the result is about £8 10s. per annum per kW of consumers demand plus 0.2d. per kWh. The numerical ratio between the two parts is here something over 40, although full allowance has already been made for the consumers' mean diversity factor. Even starting half way (with the grid tariff) and adding distribution overheads to the fixed charge, and distribution losses to the running charge, the result will be something of the order £7 per kW plus 0.23 per kWh, giving a numerical ratio between parts of about 30. Yet an average of all the two-part m.d. tariffs throughout the country shows a ratio between parts of only 10!

Commercial Considerations

A possible explanation (though not, I think, the true one) may here be touched upon. The above paragraphs suggest that the only function of a tariff is to represent costs, but the commercial aspect must also be considered. Particularly on the domestic side, costs must often be relegated to second place and even at times be deliberately flouted. Thus we find a house-service meter on the market which records on a lower scale when the rate of consumption exceeds a certain figure; *i.e.*, it positively rewards a bad load factor by lowering the charge when the demand goes up. This, however, is clearly a question of policy, and is done to cheapen the supplies for non-lighting loads. Such apparent anomalies should not be stressed too greatly, and they are at least prompted by an intelligible motive. What is more significant is the continued persistence of the flat rate which leaves seven-eighths of the costs unregarded, and the fact that even when the tariff is of the correct type and form to give an exact representation of costs the proportions appear to be quite incorrect. Is this also merely a matter of policy, or are the costs not what they appear?

In my opinion the facts admit of only two possible explanations. Either our tariffs are all wrong as a means of covering costs, or else the consumers' load factor is not the little tin god that we have always made it. But one cannot indict a whole nation, nor a whole profession; and the consumers' engineer (consciously or otherwise) has evidently been influenced by the fact that diversity is not a "lump sum" to be averaged over all consumers, but is an individual variable which largely compensates for the variations of individual load factor.

It is this reciprocal relationship which makes it necessary (particularly in extreme cases) to temper the strict justice of the two-part tariff with a little mercy towards the occasional user. Otherwise the man who employs electricity only once a year may have to pay five or ten pounds per kWh. In a similar way, it could be argued that the man who takes a taxi only once a year should pay something for all the time it has stood in the rank. Moreover, in each of these examples the principle applies that the lower the load factor the higher the diversity. Both justice and expediency, therefore, suggest that some credit must be given for that probability which I have called "differential diversity."

That there is some reciprocal connection between the individual consumer's load factor and his diversity factor is fairly obvious, and in a recent article G. W. Stubbings quoted figures given by me in the Electrical Review* and recently confirmed by F. S. Naylor. In an extreme case, if the loads fitted in exactly with each other on a sort of shift system, it would be possible for three equal loads, each with a load factor of 33⅓ per cent., to combine to give a 100 per cent. load factor on the system. The diversity factor then would achieve its maximum possible value—the reciprocal of the load factor. What is not so generally recognised is that there are two sorts of load factor, and that only one of these is eligible for consideration as a diversity improver.

Consider a works using electricity over a period of eight hours every day, the period overlapping the time of maximum demand on the system. Suppose that the load factor during working hours averages 30 per cent. so that the annual load factor is 10 per cent. The maximum possible diversity for such a load would then be not 1/0.1 but 1/0.3. In general terms, if L is the ratio:—length of connection period/total time and F is the mean load factor during connection, the true annual load factor is the product of these, namely LF. But the diversity factor is related only to F not to L, and may be tentatively expressed as $(1/F)n$ where n is less than unity. Before this relationship can be evaluated it is necessary to know more precisely what is meant by diversity.

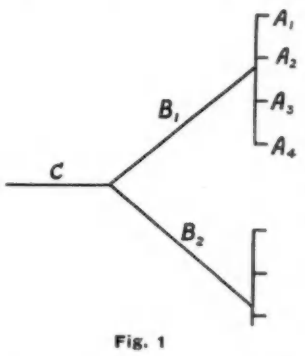


Fig. 1

There are two sorts of diversity, group and individual, and only one of these is susceptible of simple and precise definition. When a number of lines A_1, A_2, A_3 are fed from a common line B_1 (fig. 1) there is a group diversity of A : B equal to the sum of the maximum demands at A divided by the maximum demand at B. In a similar way there is a group diversity of A relative to any point C further back in the system, which can be defined in the same way; but this does not tell us the individual diversity of any one of the A lines. If, however, all the A lines have the same load factor (*i.e.*, the same ratio of kWh to m.d.) it will be fair to say that each A line has a diversity relative to B of the value defined above. For in this case there will be a certain fixed ratio between the load factor of any A line and that of B, and the diversity factor of A can be defined as the reciprocal of this ratio.

To simplify matters, suppose that the A lines consist of a number of water heaters each with a load factor of 15 per cent., and that the load factor of B is 30 per cent. Since the kWh in B equals the sum of the kWh in A, this must mean that the m.d. in B is only half the sum of the m.d.s in A. Hence, there is a diversity factor between A and B of 2, and this can be credited to each of the A lines. But if A_1, A_2, &c. differ in load factor, it is impossible on the above definition to know with what diversity to credit any one of them.

Individual diversity can, I think, be defined only on the following lines. The diversity of any one line A_1 relative to B is the reciprocal of the probability of A_1 being in circuit at the time of m.d. in B. For this purpose it is necessary to suppose that A_1 itself represents a number of precisely similar (but not identical) loads, *i.e.*, loads having the same magnitude of units and of m.d.s, but the latter not necessarily synchronising. Three different statements will then define and illustrate the diversity of A relative to B. It is the number of 1-kW loads of the type A necessary to raise the m.d. of B by 1 kW; it is the sum of the m.d.s in A divided by that portion of the m.d. in B which is due to A; and it is the sum of the kW demands in A divided by the kW in A *at the time of the m.d. in B.*

The above statements are worded as though the m.d. were measured at a particular instant instead of being spread over 15-, 20-, or 30-minute periods, but precisely the same form of definition will serve for the normal methods of metering. Taking half-hour periods, the last definition can be written as follows: The diversity of an A group relative to B is the sum of the maximum half-hour (kWh) recordings in A divided by the number of kWh taken by A during the half-hour when

* April 29th, 1932, September 27th, 1935, and January 10th, 1936.

B is a maximum. This definition has the great advantage that it does not require any measurements in B, merely a knowledge of the time of day that B records its maximum. It can be used to define the diversity of any single load relative to any other point in the system. It represents actual costs of supply, since it tells precisely how much a particular connection raises the maximum load on a feeder or the fixed cost of the bulk supply. All it needs is a little imagination to create in the mind a group of consumers of the type considered, and then to visualise their load characteristics.

Diversity and Numbers

Enough has been said to show that diversity factor is a sort of average and must, therefore, imply a number of connections, and, moreover, similar connections. It is meaningless unless there are several of a kind. When one says that a load A has a diversity of 2 relative to B this means that a *number* of loads of the kind A would only produce a demand on B of half their total demands. This fact stands out most clearly if the instantaneous conception of demand is employed, and especially in connection with apparatus such as heaters which are on full load all the time they are connected. A single piece of apparatus of such a kind cannot really be said to have any diversity at all. It cuts in at certain times and cuts out at other times. Either it is in circuit at the moment of maximum demand, or it is not. In the one case its diversity is merely unity, in the other case it is infinity; it cannot have any value in between. What is meant by a diversity of 2 for a single load is that there is exactly a half-and-half chance of its being in circuit at the time of maximum demand; in other words, that if there are 100 of them, 50 will be in circuit at this time.

The theory of diversity is, therefore, essentially a theory of probability, and requires numbers for its operation. To find the effect of A upon B we must suppose a considerable number of As. If we toss a penny once it must come down either head first or tail first—it cannot be half way between. The correct proportion of heads and tails can only arise when a number of tosses are made.

This dependence of diversity upon numbers can best be seen in the case of group diversity. Unfortunately, diversity is a quantity which is very rarely measured in practice, and, owing to the number of variables, a great many readings are necessary in order to establish satisfactory results. Thus, for group diversity, not fewer than fifty to a hundred similar appliances should be connected to a single line and their individual and collective maximum demands measured over a considerable period. One of the most comprehensive tests of this kind that is on record is the survey of water heaters carried out by the American National Electric Light Association.* Groups of fifty or more similar heaters were tested over a normal domestic cycle, with the following results. The group diversity factor rose with the number connected, being, of course, unity with one heater and reaching a steady maximum value by the time some fifty to sixty were connected Greater numbers than this were not found to produce any appreciable further change. The diversity factor (with 50 or more connected) reached a figure of between 2 and 5, depending on the load factor, and two typical curves are reproduced in fig. 2.

Group.	Number of heaters.	Mean individual m.d.	Group m.d.	Diversity factor.	Mean weekly conspn.	Load factor %	
						Group.	Indiv.
A	66	3.69 kW.	50.95	$\frac{3.69\times66}{50.95}=4.78$	34.9 kWh.	26.7	5.58
B	60	3.02 kW.	68.88	$\frac{3.02\times60}{68.88}=2.72$	50.7 kWh.	27.2	10.0

Although the diversity rises rapidly with the first few connections, a considerable number is needed to produce the maximum effect. Even when ten are connected the curve is little more than half-way up to its asymptote. Another point of note is that a reciprocal connection is clearly evidenced between individual load factor and diversity factor. The individuals in group B have nearly twice the load factor of those in group A (10 in place of 5.6) and their diversity factor is somewhat over half (2.7 instead of 4.8). A further reference to this and other relevant matters will be made subsequently.

In the case of individual diversity, one is dealing not with the probability of a number of similar loads being on together, but with the probability of a certain load being on during a particular half-hour—the metering half-hour of the system. If there were actually only one such load a diversity factor could only be said to arise as a consequence of ignorance. For it then expresses the *chances* of the load occurring or not occurring at the time of m.d. If the fact were known, the diversity could only be said to be either unity or infinity as

*N.E.L.A. Proceedings, Vol. 89, New York, 1932.

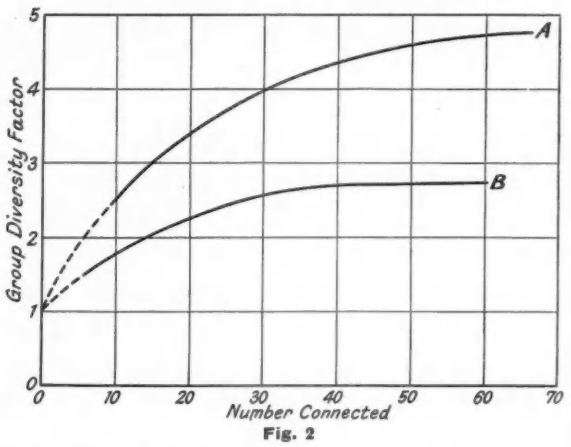


Fig. 2

the case might be (neglecting the possibility of a partial overlap). If, however, there were a number of similar loads the diversity factor would express the *proportions* of the loads that occurred during the m.d. period, just as in the case of group diversity. In fact, granted sufficient similar connections, the results would approach a steady value of diversity, as in fig. 2.

The above results could doubtless be interpreted in terms of the ordinary theory of probability, and even be given quantitative expression as a form of the "probability curve." There is great danger, however, of building a fascinating and mathematically satisfying edifice upon the frail foundations of a few ambiguous and totally inadequate facts. Until sufficient tests are made and data are forthcoming, it is better to be frankly empirical rather than pretentiously scientific. I therefore prefer to set up an outline or framework which is admittedly suppositional and empirical. This framework has the advantage, first, that it reconciles present practice as regards tariffs with known data as regards costs, and, secondly, that it seems flexible enough to accommodate itself to whatever fresh facts come along. If and when comprehensive diversity tests are made, the framework can either be extended to suit them or else scrapped to make use for the true science of the future.

Hot-plate Characteristics

TEST data relating to the relative importance of thermal storage in a hot-plate and resistance to heat transmission by lack of good thermal contact are cited in *Elektrotechnische Zeitschrift*. These types are compared: (1) A 4.4-lb., 1,400-W hot-plate, with an ordinary thin-bottom utensil. (2) A 0.67-lb., 1,200-W hot-plate (special light construction), with an ordinary utensil. (3) The same hot-plate as in (1) but with a special utensil having a thick, flat bottom. The "boiling time" is defined as the time required to heat 1¾ pints (one litre) of water from 68 to 203 deg. F., and values for this are given in the accompanying table, together with analyses of the heat distribution in each case.

	Boiling time.	Surface deg. F.	Wh. consumed.	Per cent. of heat		
				Stored.	Lost.	Utilised.
	m. s.					
(1)	13 19	801	309	35	35	28.2
(2)	11 23	1,337	222	19	39	41.0
(3)	8 14	531	191	36	17	46.0

Special attention is drawn to the fact that 70 per cent. of the heat is either stored or wasted in case (1), and of the total heat flow about 51.5 per cent. is by metallic conduction, 41.5 per cent. by conduction in the air film, and 7 per cent. by radiation. The higher efficiency in case (2) is attributed to the reduction in weight, and the transference of heat in this instance is 23 per cent. by metallic conduction, 48 per cent. through the air film, and 29 per cent. by radiation. The marked improvement in efficiency in case (3), compared with case (1), is due to the better thermal contact and predominance of metallic conduction.

This provides justification for stiffened, machined hot-plates but at the cost of increased storage of heat, whereas the results in case (2) show that the unfavourable effect of thermal resistance due to non-rigid plate and uneven utensil can be largely offset by a reduction in the weight of the hot-plate. There remains, however, the high surface temperature resulting from poor thermal contact, and this introduces risk of premature mechanical or electrical breakdown. The ideal, so far as this type of hot-plate is concerned, is the best metal-to-metal contact that can be obtained without increasing the weight.

Correspondence

Contributions from readers are welcomed. The writer should give his name and address, not necessarily for publication

Domestic Apparatus in China

Your issue of February 7th, which has reached me to-day, contains an article on automatic cooker control that particularly interested me as I am considering the hiring out of electric cookers here.

In China cooking is mostly done by Chinese servants, and electric cookers are extravagantly used, making them an uneconomic proposition for the housewife. With thermostatic control, however, the load might be developed. It is essential that the thermostat should be easily adjustable to whatever temperature the housewife or cook may require. At a price of 35s., the additional equipment would be well worth while, even if it were cut out when not required.

Where voltage varies considerably, there is no question that thermostatic control would have its advantages, and I think British manufacturers should bear the foreign market in mind when considering designs.

Small circuit breakers have reached a satisfactory stage of development and should stand up to the long usage with the frequent make and break operations required of them. Our system being d.c., conditions are more severe than on the a.c. system at home.

Another matter to which I have been giving attention is the use of a meter combined under one cover with the company's switch and fuses as a single unit. At present the meter is on a cheap wooden board and the switch and fuses are of a type that lends itself to the stealing of electricity or the change of fuse capacity by the consumer without difficulty. A combined unit would eliminate a considerable amount of wiring and render theft difficult. Distribution losses on our overhead systems during the winter months are as much as 40 per cent. of the kWh generated, mainly due to theft. Legal proceedings are useless, but when we discover flagrant cases we cut off the supply and do not reconnect until we have exacted a fine.

Although we have a d.c. station, the tremendous demand for supplies for radio makes it necessary to supply a.c., and some consumers take both supplies. Eventually we may change over to a.c., but capital is not easily raised in this country at the present time. The short-wave radio receivers here are of American manufacture; with sets at the equivalent of £18 at the present rate of exchange, excellent results are obtained. The radio market here is a rapidly extending one and British manufacturers should find it well worth while to attempt to secure it.

G. B. Gill,
General Manager in China,
Hankow Light & Power Co., Ltd.

Hankow, *March 14th.*

Earthing and Testing

Mr. H. R. Taunton admits that he made a slip of the pen in applying the word "impracticable" to the safety method whereby in a bathroom all metal is bonded together to ensure a uniform potential throughout. It must be remembered that this method is only to be adopted should there exist metal which is liable to become alive and which cannot be shielded or concealed. As I said in my first letter, Regulation 1002 is a godsend when such metal apparatus as cookers and wash-boilers are installed in scullery-bathrooms. Anyway, is a length of copper tape so terribly unæsthetic when compared with water-pipes and taps?

And has Mr. Taunton been guilty of another slip of the pen when he states that the risks in a bathroom are no more than those in any room above the ground floor? It will seem so to many readers. His best way to convert the I.E.E. Wiring Regulations Committee and myself would be for him, in our presence, to duly place himself in a bath of water and ask for various running appliances with low insulation resistance and defective or deficient earthing to be handed to him. He might feel somewhat immodest before the company and therefore would be allowed to retain his clothing, but the result, I warrant, would be the same; he might then be prepared (even before the commencement of the test) to agree that the bath-room is much more likely than other rooms to be a lethal chamber.

Seriously, in view of the recorded accidents and that host of minor ones which may cause people to doubt or fear electricity, I am sure most readers will agree that special care must be taken with regard to bathroom installations. It is no use Mr. Taunton comparing a natural force like gravity (of which, willy-nilly, we are constantly aware) to electricity (man-made and, whenever used, to be controlled with due respect).

I shall not labour any of the other points, but I cannot resist saying as a rejoinder to the ironic suggestion that the light should be put outside the bathroom that this would be both practical and practicable. It has (I believe) been done and it is, after all, on the same lines as lantern lights and bulkhead fittings. The arrangement is utterly safe; a tiny bathroom is not therefore restricted by any lighting fitting; and the hot moist atmosphere has no effect.

Finally, do let us remember that the I.E.E. Wiring Regulations are an earnest attempt to set forth a safe and up-to-date standard, and that they were drawn up by a most representative body of men. Prolix, too "semi-legal" and vague they undoubtedly are in parts, but these parts are not many. As a whole the regulations form a compact and well-sectionalised code, and they include an impressive amount of tabulated and other data that are beyond and above argument and are of great workaday value.

G. E. Moore.

Sunderland, *April 11th.*

I do not think it is quite correct that the I.E.E. Wiring Regulations are mainly intended for the average wireman as Mr. Taunton suggests in his letter in your issue of April 3rd. If this had been the intention of the Wiring Regulations Committee, the phraseology used in the tenth edition would have been much more simple than is the case.

The Regulations in the main are understandable to supervising engineers, although I agree that it is necessary to read the regulations carefully and to link up all the relative regulations in many cases. This difficulty has been met to some extent by my Association, by the publication of "The Employees' Guide to the I.E.E. Wiring Regulations." The aim of this booklet is to explain pertinent regulations in language understood by the average wireman and by means of diagrams and explanations to give an indication of what the Committee intended in many cases.

By the use of this "Employees' Guide," the wireman can obtain a grasp of the intention of the Regulations which are of importance to him in his everyday work.

A. Brammer,
General Secretary,
Association of Supervising Electrical Engineers.

London, W.C.2, *April 7th.*

The Meter Engineer's Status

It is time that the meter engineer's importance in an electricity supply organisation was more generally recognised. It is first necessary, however, that the employer should get rid of the idea that meters are the be-all and end-all of the meter engineer's usefulness to the undertaking, and that he should recognise the fact that a meter department can only function satisfactorily when certain fundamentals are observed. These fundamentals may be classified as follows:—

(a) Proper housing of the department with sufficient space available for sectionalising its activities; test rooms preferably situated on the top floors of buildings and not in basements.

(b) An adequate stock of high-grade sub-standard apparatus and, if the size of the undertaking justifies it, proper faci-

The stand of Messrs. Falk, Stadelmann & Co., Ltd., at the Ideal Home Exhibition

lities for carrying out standardising of all classes of instruments on the premises. Expenditure in this direction will justify itself by increasing the efficiency of the system as a whole.

(c) A staff of competent reliable men with sound technical knowledge, adequate in number and suitably recompensed. This is essential for the efficient working of the department and will lead to an increased ability to deal with matters far wider in range than pure metering.

In my opinion *all* electrical testing of whatever nature usually can best be carried out by the meter staff provided that the above fundamentals are observed and the department is organised with this end in view. The meter engineer would in effect become the meter and testing engineer, and a standard grade could then be allocated to his class of work under the N.J.B. Schedule.

At the present time his grading, and therefore salary, is entirely dependent on what importance his employer attaches to the job with the result that there is no uniformity of treatment throughout the industry; the more enlightened, shall we say, consider him worthy of Grades 6 or 7, whereas the unenlightened (the large majority) relegate him to Grades 9 or 10. The latter ask for mediocrity and they invariably get it.

There are " chiefs " who will go to quite considerable expense in fresh personnel to save ½ per cent. on the coal bill, or on distribution losses, but either cannot or will not see the necessity for any expenditure to gain ½ per cent. in metering accuracy, despite the fact that this is the very source on which they rely for the measurement of their revenue. They should ask themselves the question: " Is the man who is responsible for maintaining the accuracy of 10, 20, 50 or more thousand meters worth more than a highly paid clerk or not? "

I speak from experience in working for an undertaking which some years ago adopted such a progressive policy, with the result that most of the technical problems, tests and experimental work, originating in many cases from other departments, are to-day undertaken by its meter and testing department to the entire satisfaction of all concerned. E. C. M.

April 10th.

Small Single-phase Motors

Referring to Mr. E. K. Bottle's interesting article on " Fractional H.P. Single Phase Motors " in your issue of April 10th, may I be permitted to point out two remarks which I think are not accurate?

In the paragraph dealing with synchronous-reaction motors he states that starting is accomplished in a similar manner to that of a split-phase motor. My own experience is that it is practically impossible to do this, as the starting winding has to be open-circuited at something over the slip speed. This entails a most accurate and sensitive fling gear, and a tolerance in speed rise of 50 r.p.m (on a four-pole machine) is not large enough to guarantee positive action. I have found that the only satisfactory method of starting these single-phase synchronous motors is by using a capacitor-type winding. Perhaps, however, Mr. Bottle in mentioning the split-phase machine, may be also referring to the capacitor type, but if this is so I think it is somewhat misleading, as it is now generally accepted that although both types are " split-phase " they are differentiated by defining them by the two terms " split-phase-start " and " capacitor-start."

The second and more important point which I think is in error is a remark that this type of machine is " relatively large having about 33 per cent. of the induction output with the same frame." My company is manufacturing single-phase synchronous motors with an output of 90 per cent. of that of an induction motor together with a starting torque of 150 per cent. full load, this starting being accomplished without any auxiliary switching. P. S. Firmin.

Croydon, *April 9th.*

Individual v. Group Drive. By J. M. Reekie

THERE has recently appeared in America a publication prepared by the Mechanical Power Engineering Associates (a group of mechanical transmission companies) the object of which is to prove that the individual drive in a factory may not always be the most efficient. As a result of the success of this organisation a similar association has been formed in this country, and its first publication sets out the relative advantages of the two types of drives.

I believe, however, that the individual drive will become increasingly popular, and should be glad to learn the opinions of your readers on the subject. The price per horse-power for a ½-h.p. motor is shown as nearly nine times that for a 40-h.p. of the same type. Now, it is true that the individual drive is generally the more costly to install, but where machines are not running continuously a number of tools in a line of machines may be shut down resulting in a material saving of power costs. In the individual drive, too, the motor is likely to be coupled direct to the driven machine when the cost of the transmission in the group system should be added to the 40 h.p. for a true comparison.

The group drive does, however, reduce the total installed h.p. in a factory and enables a higher power factor to be obtained, but this can be taken care of in the individual drive by means of power-factor correcting apparatus. The great disadvantage of the group drive is the overhead transmission systems with their attendant belt dangers and exclusion of daylight. There is also the difficulty of works reorganisation especially when installing a new type or a new line of machine tools for a mass-produced product.

It is stated that wherever a countershaft or built-in speed-change device is required on a group-driven machine, it will also be required for the individual drive, except with still higher-cost variable-speed motors!

In recent years, chiefly because of the popularity of the individual drive, small a.c. motors have been obtainable with a gearbox in one unit as a standard product. This gives very low speeds at a comparatively low cost. With a combination of a variable-speed gear and a small a.c. motor arranged to give electrically, say, three speeds, a very wide range of speed change can be obtained. Where true variable speed is required the a.c. commutator motor will effectively meet the requirements, and its somewhat high price will no doubt decrease as the demand for this type increases.

With the group drive advantage cannot be taken of the electrical characteristics of one large motor as in the case of the individual drive. Take, for instance, a line of twenty machine tools where perhaps ten are running at half speed and the other ten at full speed; in the group drive the speed change must be done mechanically but with the individual drive the electric motor can be wound as a standard job to give the two speeds.

A comparison of investment cost between unit drive and modern group drive is made as follows:—

Individual Motor Drive.	$	Modern Group Drive.	$
Cost of four 7½ h.p. motors ...	492	Cost of one 20 h.p. motor ...	215
Cost of four 7½ h.p. drives, incl. labour	170	Cost of line shaft, etc., incl. labour	230
Cost of four switches, etc. ...	494	Cost of controller, etc.	219
	$1,156		$664

Generally where a large number of machines are driven on the unit system by identical motors a spare motor is kept; moreover, should one motor burn out only one machine is stopped. The larger spare motor for a group drive is costly and while the replacement is being made all the machines on that group are shut down.

The lower electrical efficiency with the individual drive may be nullified by shutting down individual units when not required, and manufacturers are devoting attention to increasing the efficiencies of standard small motors. A difference of ½ per cent. on each motor can be an appreciable amount on the power bill on a year's working.

With the modern group drive there is only one motor and one starter, with possibly one more belt, to maintain, but in the individual drive the cost of spares is considerably less and removal of faulty machines or parts does not seriously hamper production.

With the group drive the speed is practically constant, but the individually driven machine is generally designed to operate at the speed corresponding to the full-load speed of the motor; when the load on the motor is decreased production is increased.

These remarks have related to belt drives. The present tendency is to direct-couple the motor to the driven machine which gives further advantages to the individual drive. Moreover, restrictions may be imposed by the electricity supply undertaking, and a motor of 40 h.p. may have to be of the slip-ring type, whereas 5 h.p. units could be of the squirrel-cage type.

Oxy-acetylene Welding Congress

The twelfth international congress of acetylene, oxy-acetylene welding and allied industries is to be held at the Caxton Hall, Westminster, from June 8th to 13th. It is being organised by the British Acetylene Association, and there is to be an exhibition of equipment and materials of technical interest, not a trade display. The congress will be the only one of its kind held in this country for twenty-eight years.

Power from the Liffey

FOLLOWING discussions between the Irish Free State Department of Industry and Commerce, the Electricity Supply Board and representatives of the Dublin Corporation, a provisional agreement has been reached on a scheme for a combined hydro-electric and city water supply for Dublin by the establishment of a reservoir on the River Liffey at Poulaphouca. The scheme has now to be approved by the Dublin Corporation, by whose representatives it has been accepted, and the work will be put in hand immediately, the Government being prepared to rush through the necessary legislation.

The scheme, which was drawn up following exhaustive reports recently presented to the E.S.B. and the Corporation by Herr Buchi, the Swiss water-power expert, and Herr Meyer Peter, is substantially that sponsored by Sir John Purser Griffith, Mr. Moynihan and Mr. L. Kettle (*vide* ELECTRICAL REVIEW, January 20th, 1933). It provides for the building of a large reservoir at Poulaphouca at a cost of about £200,000, and the building of an open aqueduct or concrete pipe-line to a new service reservoir at Belgard Hill, one and a half miles from Clondalkin, to supply the north side of the city and suburbs with 12½ million gallons of potable water daily. The cost of this part of the scheme, carried out in conjunction with the electrical scheme, is estimated at £500,000.

The estimated cost of the full scheme is £1,200,000. It will take some four or five years before the work is completed. Three square miles of the Liffey valley, involving the removal of about thirty families, will be required for the reservoir, which will be about 100 ft. high.

The main difficulty which had to be overcome in the negotiations was that the scheme will supply the Electricity Supply Board with more power than it will require for ten years, and it was not willing to advance money which would be unproductive for so many years. The economic deficit thus raised was about £185,000, towards which the City Manager had offered on behalf of the Corporation about £85,000. Although the details of the agreement have not yet been published, it is understood that the Government has expressed willingness to meet the greater part of the remainder out of the Exchequer.

The development of the Liffey has been under consideration for a number of years; in fact it was suggested before the Shannon scheme was mooted. According to Mr. R. N. Tweedy, who discussed the subject in our issue of February 22nd, 1935, it was estimated by the promoters of the original proposals that 40 million kWh could be produced from the Liffey, but as this was considerably less than the requirements of Dublin alone, it was decided to proceed with the Shannon scheme, leaving the development of the Liffey to afford a supplementary or stand-by supply at some future date.

A scheme prepared by Messrs. Siemens-Schuckert was outlined by Mr. Tweedy. This involved the diversion of the Liffey from the south to the north of the Dublin-Wicklow mountains and the installation of a station on the coast between Dalkey and Bray with a capacity of 90,000 kW. With the addition of water from subsidiary catchment areas an annual output of 110 million kWh was considered feasible.

The I.E.E. at Manchester

THE annual dinner of the North-Western Centre of the Institution of Electrical Engineers was held at the Midland Hotel, Manchester, on April 7th, when the chairman, Mr. E. C. McKinnon, presided over the largest gathering yet recorded for this function. The toast of "The Institution of Electrical Engineers" was proposed by Mr. A. E. Jalland, who, speaking as a member of another profession, the Bar, referred to the community of outlook of all professions in placing services rendered before remuneration. He believed that electrical engineers would do good, directly to the community and indirectly to themselves, in getting rid of the pall of smoke over our cities. They should do everything possible to urge railway electrification. The best hope for the world lay in the formation of public opinion by professional men, who were international in their aspirations.

Mr. J. M. Kennedy (president, I.E.E.), responding, disclaimed any knowledge of what the McGowan Committee on Distribution was likely to recommend, but he was sure that there was a need for the simplification of tariffs and methods by which electricity was sold. Members who attended the summer meeting of the Institution in Glasgow on June 15th could be sure of having a most enjoyable time. He anticipated that the membership of the I.E.E. would have risen to over 17,000 by the end of his year of office, and expressed the hope that the prosperity of the industry would be reflected in an increase in the Benevolent Fund, the golfing competition on behalf of which he commended to the attention of the members.

The chairman, proposing the health of "Our Guests," stated that the demand for tickets for the dinner had considerably exceeded the maximum of 417 for which accommodation could be found. There were present, he said, two past-presidents of the I.E.E. in Professor E. W. Marchant, from whom many present had received their academic training, and Mr. J. S. Highfield, who had started in Manchester, and, in addition, fifteen past-chairmen of the Centre. Another old Manchester man among them was Mr. W. McLelland, late Director of Electrical Engineering to the Admiralty, who had succeeded his (Mr. McKinnon's) old colleague, Mr. F. W. Crawter, who was also among the guests, as chairman of the membership committee.

In his response, Mr. H. W. Archer referred to the part played by electrical engineers in lightening the work of women in the home and the scope for railway electrification, trolley-buses, and street lighting.

Mr. J. S. Highfield, in thanking the chairman, gave some reminiscences of his early association with Mr. McKinnon, in 1894, in a battery test house, with especial reference to accumulator traction. In his reply, the chairman paid a tribute to the work of Mr. L. H. A. Carr (hon. secretary) and Mr. A. L. Green (assistant secretary) in organising a very successful function.

Parliamentary News (BY OUR SPECIAL REPORTER)

IN the House of Commons on April 17th Mr. Salt asked the Minister of Transport if he could state the total capital expenditure, up to the latest available date, of providing the grid system of electricity in England and Wales; and what was the lowest price per kWh at which electric current could be supplied for public use, such as the lighting of roads.

Captain Hudson said that the accounts of the Central Electricity Board for 1935 showed that the total capital expenditure on the grid system in Great Britain for general purposes other than standardisation of frequency amounted at the end of that year to £34,643,643. No direct supplies for public use such as street lighting were given from the grid system.

Interference with Radio

On April 8th Mr. Hall-Caine asked the Postmaster-General what was the present annual expenditure by his department on the prevention of interference with wireless broadcasting reception in Great Britain; and whether he had considered the possibility of reducing this expenditure by introducing legislation or obtaining a legal decision to the effect that such interference could be compulsorily prevented.

Sir W. Womersley said that the annual expenditure by the Post Office in assisting owners of wireless sets to obtain broadcast reception free from interference was at present about £80,000. The whole subject was at present under consideration by a committee appointed by the Institution of Electrical Engineers, on which the British Broadcasting Corporation and the Post Office were represented, in addition to the electrical and wireless interests concerned. The question whether there was need for legislation would be considered when the committee's report was received. It was not the practice to deal with complaints of interference with the reception of foreign programmes. The number of engineering officers at present employed in dealing with cases of interference with broadcast reception of British programmes—expressed in terms of full-time staff—was 234.

Radio Relay Services

On April 9th Mr. Levy asked how many licences had been granted for wireless relay services in this country and how many separate companies were concerned; and whether he was satisfied that proper facilities were being provided.

Sir W. Womersley said that licences to operate wireless relay services had been granted to 295 companies or individuals in respect of 343 exchanges; and, so far as he was aware, the conditions laid down in the Post Office licence had generally speaking been observed.

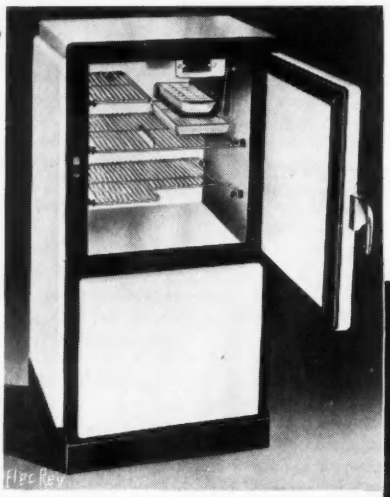
Answering a further question, he said that complaints regarding relay services would normally be addressed to the operating companies concerned and not to the Post Office. A few complaints had, however, been received by his department, mainly relating either to interference caused by relay wires or to the inclusion in, or omission from, the programmes of broadcasts from foreign stations.

Progress in Refrigeration

A review of developments in the domestic field

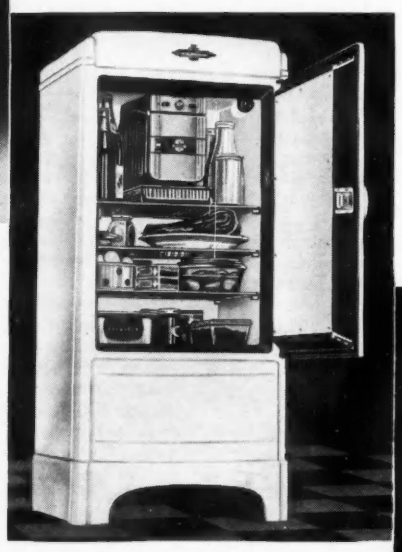
THERE were people who, when the gas companies started upon their refrigeration campaign, feared a severe decline in the output of electrical refrigerators. Actually, there is now probably more optimism in both the electrical and refrigerator industries than ever before; sales have increased rapidly and no fewer than nine concerns have entered the refrigerator market for the first time during the past year.

Nevertheless, although the gas campaign has, to a large extent, reacted favourably to the electrical industry by demonstrating to the public how useful a refrigerator is in the home—particularly where there are children who require fresh milk—it has also spurred on the electrical industry to make greater efforts in this direction.



A new Kelvinator refrigerator, the 3 cu. ft. "BK.30"

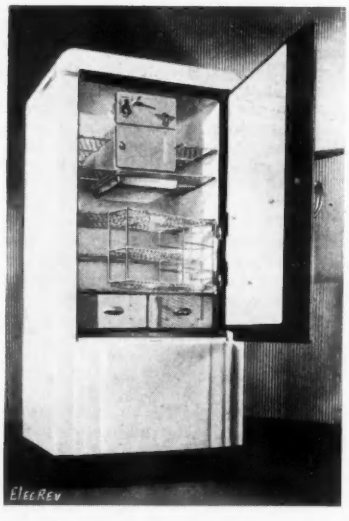
The business cannot be left to the gas industry, and if we are to avoid this energetic sales campaigns, backed by the supply authorities, are a necessity. Happily, we have every reason to believe that this is already realised by the industry. When the gas companies originally put forward a hire-purchase scheme, charging 2s. 6d. a week, they had this market to themselves, and about 7,000 refrigerators were sold in the first eight months of 1935. Now a number of electrical undertakings—the Northmet Co., and Ealing and West Ham Corporations for example—are offering refrigerators at the same weekly rate, while the London Associated Electricity Undertakings, Ltd., and Gravesend Corporation are preparing special schemes.



A Frigidaire newcomer, the 4.1 cu. ft. "Master 4"

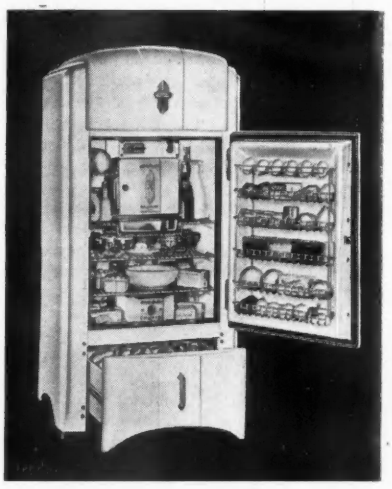
These refrigerators are generally of about 3 cu. ft. capacity, whereas that of the equivalent gas refrigerator is only 2 cu. ft. Now, however, a gas company, is offering a 1 cu. ft. model at under 2s. a week, and Electrolux, Ltd., which has suspended the production of its electric models, so far as the home market is concerned, is supplying this size of gas model for only 1s. 8d. a week.

On the ground of running cost the electrical refrigerator scores easily: a 3 cu. ft. model of the compressor type can be run at an average cost of 16s. a year with electricity at ½d. per kWh, whereas a 2.2 cu. ft. gas model will cost about £2 5d. with gas at 8.6d. per therm. Freezing speeds are also greater with the electrical models, ice being formed in a third of the time taken by gas, while since no fumes or appreciable heat are given off by a compressor when electricity is the motive power, special ventilation arrangements are unnecessary. These are all points to be brought home to the prospective purchaser, while the fact that the load is essentially a summer one is a factor which should appeal to the progressive electricity supply undertaking.



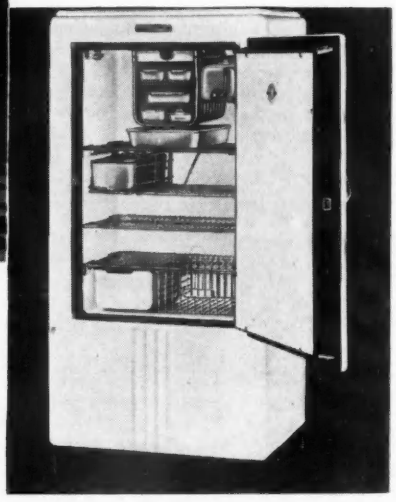
The Cooper-Stewart "Sav-a-step" de luxe model 866P refrigerator

Hitherto the Electrolux has been the one outstanding example of the absorption type of refrigerator which operates by the application of heat to a liquid refrigerant. This principle is now also applied to the new "Zeros," which is available with a coloured finish, and the "Frigedom" models. This system has the advantage of not needing any moving parts, but against it may be put the increased consumption, the loading being nearly three times that of the compressor type. To balance this is the fact that where it is not essential for the consumer to be able to vary the degree of cold, the time switch which controls the operation can be set to operate during off-peak hours only.



A "Crosley-Shelvador" de luxe model

The fact that the "Frigedom" is made by manufacturers of kitchen cabinets is shown in its unusual design, drawers and a cupboard being incorporated in the base of the refrigerator. Granulated cork is used for the insulation, which, it will be noticed from the illustration, is unusually thick.



The Lightfoot "Westinghouse" model "ED.70"

There has been little radical change in the B.T.H. refrigerators, whose distinctive "hat" makes them so easily recognisable. The mechanism housed in this cabinet is hermetically sealed, so that should any trouble occur the whole of it can be removed complete and replaced by new equipment, without incapacitating the refrigerator for very long. Three special *de luxe* models (the "GL" series) are introduced this year. They are of improved appearance, the top having a smooth surface, and are equipped with a control in the centre of the circular top, by means of which defrosting can also be carried out. For this series the guarantee is extended to five years. A departure for this company is a 3 cu. ft. model (F.T.30) with the compressor housed below the cabinet on orthodox lines, while the "Coldrator 44" is a newcomer designed for operation only on d.c. supplies.

Kelvinator, Ltd., announces a complete new range with a more attractive finish and improved appearance. Some of the special features are double-depth trays, a finger-tip control giving fast freezing, a "vacation" setting, a sliding shelf, a "sorting shelf," and three covered china dishes to store left-over food. The new low-priced models, BK-25 (2.5 cu. ft.) and BK-30 (3.1 cu. ft.) with front-opening doors, are available in addition to the top-opening "Kelvinettes."

Frigidaire refrigerators have been available now for eighteen years, and, we are told, nearly four million installations have been sold. The 1936 range comprises six models of from 3.1 cu. ft. to 15.1 cu. ft. capacity, including a special design of ice freezer. A patent automatic tray release is incorporated,

and with the "Master" models 4 and 6 a hydrator is supplied to keep vegetables fresh and crisp, while the larger model also has two sliding shelves. Chromium plate is used for hardware.

Considerable increase in the ice-making capacity of the "Coldair" refrigerators has been made this year, and the compressors are now mounted on rubber instead of springs. With the exception of the 3 cu. ft. table-top model, automatic interior lamps, hydrators and egg baskets are standard. A newcomer, No. 8A, which has a storage capacity of 8½ cu. ft., is designed on the same lines as the present 5-cu. ft. size.

In introducing the new H.M.V. "Economy" models an effort has been made to produce 3½ and 4½ cu. ft. refrigerators at the lowest possible price without omitting the essentials. They are marketed side by side with the "Standard Streamline" models. The fashion for refrigerators, since the disappearance of the wooden casing, has been for a white enamel or porcelain finish, but a new style has been set by H.M.V. in making the 6.2 and 7.2 cu. ft. *de luxe* models available in an attractive mottled coloured porcelain finish. A new feature is a tip-down fruit and vegetable basket so designed that it cannot be permitted to drop down past a certain point.

The "Frigedom" combined refrigerator and kitchen cabinet

No new "Prestcold" refrigerators are being introduced this year, but certain improvements in design have been made, particularly in the compressor unit, where special attention has been paid to cooling.

Several changes have been made in the "Westinghouse" refrigerators, the hermetically sealed compressor now being fitted into the base of the cabinet, thereby raising the bottom shelf by 9½ in. The forced draught cooling prevents any heat leakage from the compressor; an air tunnel is situated at the back of the cabinet, the air from near floor level being drawn through this over the motor and condenser and exhausted through a baffle from the rear of the cabinet. A novel feature is the "Eject-o-Cube" ice tray. Moonstone ware replaces clear glass and food-saving dishes are incorporated in most of the models, while an adjustable shelf enables extra storage space to be obtained for large joints in special circumstances.

In the new Sparton range a very low-priced 2½ cu. ft. model is accompanied by a similarly designed 3½ cu. ft. size. It is of simple straightforward design with a front opening door, a flat top, and a full-size unit giving ten freezing speeds. At the other end of the scale are large double-door models with door shelves and a vegetable bin in the base, as well as an electric clock which times the defrosting to take place automatically during the night. Altogether eight models can be obtained.

A B.T.H. "GL" series refrigerator and the Coldair "4A"

For some years the "Crosley Shelvador" refrigerator (as its name suggests) has been equipped with shelves fitted into the doors: this feature is even included in the new T.20 and T.30, 2 and 3 cu. ft. table-top models with front opening doors and the compressor situated beneath the cabinet. A contrast to this is the DL.70 (7 cu. ft. net) with a store-drawer under the cabinet, a crisper, and a light-action knee-operated door handle; porcelain is used for the interior and "Dulux" enamel for the external finish. There are ten intermediate models.

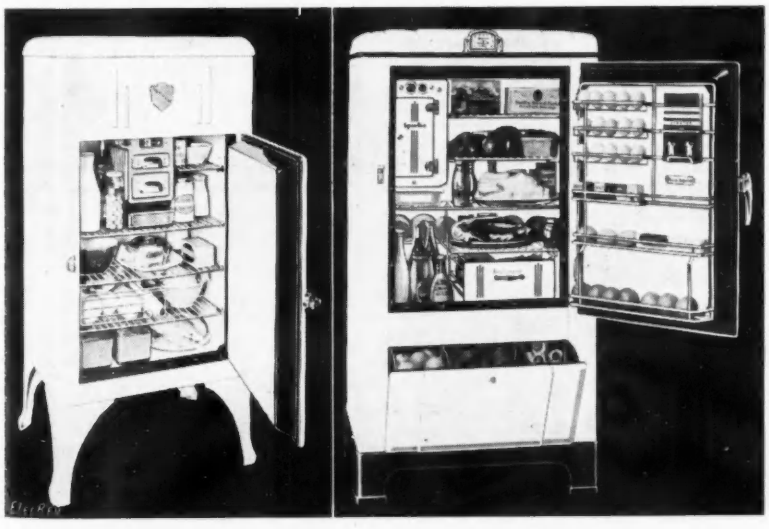
The "Prestcold S.24"

Some changes have also been made in the "Coldspot" refrigerators, all of which are newcomers and were described by us last December. The unit is easily removable, and in every case is housed above the cabinet. Specially light trays of an aluminium alloy are used, and the largest model has a glass rolling pin which can be used as a cocktail shaker. Six machines are available, ranging from the "Special 3" (3½ cu. ft.), which makes 5 lb. of ice, to the "Super 8" (8 cu. ft.), designed to make 10½ lb. of ice. The door is opened by merely touching a bar, and a divided shelf gives easy access to the rear of the cabinet. The interior is finished in porcelain enamel and the exterior in "Dulux."

A recent Leda addition is the P.2 *de luxe* model, with 5 cu. ft. capacity, automatic interior lighting, an egg rack on the door, a finger-touch door opener and three ice trays giving 3 lb. of ice. This company and Marco Refrigerators are also introducing fully-automatic refrigerated milk bars.

The Marco refrigerators have been redesigned this year with the compressor underneath the storage cabinet, which is now at a more convenient height. Four models are available with food storage capacities of 2, 3, 5 and 8 cu. ft. The "Servel," "Beach," "Zerozone," and "Sav-a-Step" refrigerators are all American machines recently introduced to the English market. There are four "Servel" models with from 3 to 6 cu. ft. food storage capacity. The compressor is mounted above the cabinet which contains, in addition to the usual trays and shelves, a sliding fruit basket and a double-depth dessert tray. The ice tray has a rubber grid with a trigger for the quick release of the ice cubes. There is a complete range of "Beach" and "Zerozone" domestic refrigerators, both of which have the compressor mounted below the cabinet.

The new "Sav-a-Step" has, as a special



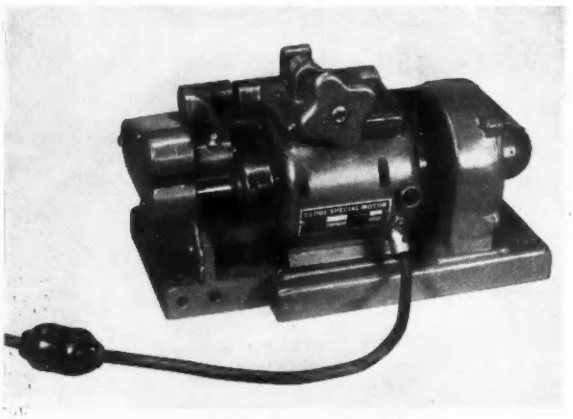
Examples of the "Servel" and "Sparton" refrigerators

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

A Wire Stripping Machine

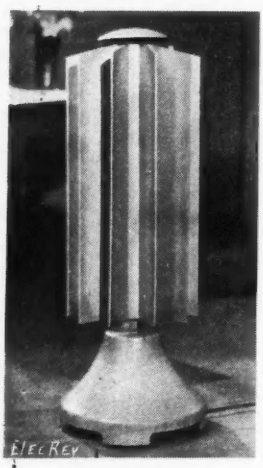
The revolving wire brushes in the "Globe" junior wire skinner supplied by MESSRS. G. E. MARBAIX, Vincent House, Vincent Square, London, S.W.1, are designed to strip enamel, cotton or rubber-covered wire and give a clean copper surface ready for soldering. The brush shafts are mounted on ball bearings, and an exhaust system is incorporated to remove



The "Globe" junior wire stripper

all dust and lint through a flexible tube extending from the base; this can be passed into a water pan to avoid any danger of fire.

As only a slot appears in the front of the case covering the mechanism through which the wires to be skinned are fed, the operator is adequately protected. Adjustment of the brushes is carried out on the top of the machine and a motor switch is situated at the front of it.



The "Dayanite" portable electric radiator

An Electrically Heated Water Radiator

As an adaptation of their paraffin stove, DAYANITE RADIATORS, 77, Grosvenor Road, Westminster, London, S.W.1, have introduced an electric model incorporating a 600-W withdrawable immersion-type element which transmits heat *via* water to hollow metal vanes. Enamel finishes to match any colour scheme are obtainable, and ball-bearing castors can be fitted. A combined plug and lampholder adaptor is provided with the heater.

A High-speed Auxiliary Boiler

In our issue of April 3rd (page 499) we stated, owing to a misprint, that the "booster" was suitable for "½ or 3 gallon" water heaters. This should have read "1½ or 3 gallon" water heaters.

Help in the Kitchen

Chopping, mixing, grinding, beating, sifting, slicing, shredding, juice extracting and ice-cube breaking are just a few of the tedious jobs connected with cooking which can be carried out rapidly and efficiently by the "Kitchen-Kit" made by MESSRS. A. C. GILBERT, 109, Kingsway, London, W.C.2.

It is, in effect, an improved model of the "Kitchenetta," which it has superseded. The design is much neater, the motor being built in and having a smooth exterior.

All adjustments and attachments are simple and can be made in a few seconds. The ⅛ h.p. universal motor has three speeds controlled by a handy switch. To give easy access to the heater bowl the machine can be tilted backward and outward on its stand, or, if preferred, lifted off entirely. Its portability also enables it to be used for mixing, etc., directly in the saucepan.

The machine is finished in chromium, and the bakelite handle is vibrationless and, therefore, comfortable to hold when the equipment is in use.

A Range of Table-type Cookers

Newcomers to electric cooker market are MESSRS. ORMR EVANS & Co., LTD., Wolverhampton. There are eight models and all are a departure from the usual British design inasmuch as they are of the pressed steel table type. The smallest model ("Chef 1523") has three boiling plates, as well as an independent double grill at the top of the oven, which is placed at the side of the hob, the whole equipment being mounted on legs to bring it to a convenient height. Nos. 5065E and B.762 incorporate extra utensil drawers and an extra boiling plate (B.762 only). The others are all designed on the table-top principle, with the oven top and hob mounted flush and white porcelain enamelled in line with the rest of the cooker. There are also roomy storage cabinets.

The 525E "Chef" cooker

In the drawer of one model and in the oven of others there is a special griller, giving a "double searing" action; this is independent of the actual oven units. An optional accessory is a little drawer in the backplate which contains a smaller grill for toasting or grilling small quantities of food. Another useful addition is a black and chromium lamp for illuminating the hob, and a clock by means of which the supply of electricity to the cooker can be cut off at any predetermined time.

Progress in Refrigeration (*Continued from preceding page*)

feature, a capacious detachable rack for holding the articles required most frequently; hinges enable it to be swung clear so that the goods stored behind it can be reached. Eleven temperatures can be obtained by means of an illuminated control.

Two British-made refrigerators which are available in all the usual domestic sizes and types are the "Chillaire" and "Moffat," while one of the cheapest, considering its size, is the "Aerofrige." A new 3½ cu. ft. model was introduced at the B.I.F. It is of straightforward design, with the compressor at the top, an effort having been made to keep the price as low as possible without dispensing with essentials. There are, however, two egg and fruit racks on the inside of the door.

Despite the increase in the number of companies selling refrigerators, almost all of them are reporting increased sales over last year.

We append a list of the makers of the refrigerators to whose trade names we have referred in our article:—

AEROFRIGE.—British Electric Domestic Appliances, Ltd., 3, Hanover Court, Moor Lane, London, E.C.2.
BEACH.—McGregor & McCullum, Ltd., 1, Newman Street, London, W.1.
B.T.H.—International Refrigerator Co., Ltd., 169, Regent Street, London, W.1.
CHILLAIRE.—Orme, Evans & Co., Ltd., Great Brick Kiln Street, Wolverhampton.
COLDAIR.—Coldair, Ltd., North Circular Road, London, N.W.2.
COLDSPOT.—Searsint, Ltd., 1, Thames House, Millbank, London, S.W.1.
CROSLEY.—A. J. Balcombe, Ltd., 52. Tabernacle Street, London, E.C.2.
ELECTROLUX.—Electrolux, Ltd., 153, Regent Street, London, W.1.
FRIGEDOM.—Kitchendom, Ltd., Stadium Works, Wembley.
FRIGIDAIRE.—Frigidaire, Ltd., Edgware Road, The Hyde, Hendon, N.W.9.
H.M.V.—H.M.V. Household Appliances, Ltd., 363, Oxford Street, London, W.1.
KELVINATOR.—Kelvinator, Ltd., 258, Gray's Inn Road, London, W.C.1.
LEDA.—Leda Electric, Ltd., Morden Road, Mitcham.
MARCO.—Marco Refrigerators (1929), Ltd., Manor Works, Streatham Vale, London, S.W.16.
MOFFAT.—Moffats, Ltd., India Mills, Blackburn.
PRESTCOLD.—Pressed Steel Co. of Great Britain, Ltd., Cowley, Oxford.
SAV-A-STEP.—Cooper-Stewart Engineering Co., Ltd., 136, Long Acre, London, W.C.2.
SERVEL.—Utilities, Ltd., 1, Newman Street, London, W.1.
SPARTON.—Sparton Refrigeration Co., 415, Oxford Street, London, W.1.
WESTINGHOUSE.—Lightfoot Refrigeration Co., Ltd., Bush House, London, W.C.2.
ZEROS.—Zeros (Sales), Ltd., Dagenham.
ZEROZONE.—Zerozone, Ltd., 14, Regent Street, London, S.W.1.

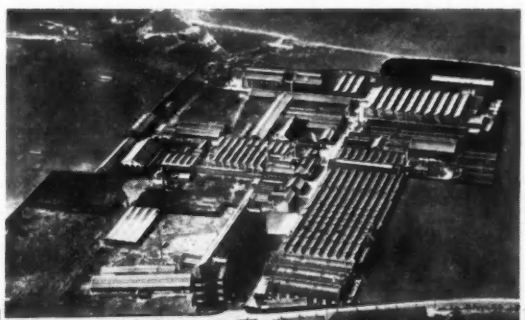
Electrical Manufacturing at Dagenham

The Works of Ismay Industries

WE recently visited the factory of Messrs. Ismay Industries, Ltd., at Dagenham. This was originally the Sterling telephone works, and covers 14½ acres. The company is interested in many electrical manufactures. Six of its lines—"Zeros" refrigerators, "Electrix" vacuum cleaners, "Halcyon" radio receivers, "Blue Spot" loud speakers, neon signs, and synchronous electric clocks—are made at Dagenham, but others which are being produced at seven factories situated elsewhere in Great Britain include lamps, batteries, cables and "Lumolite" signs. Their "Connor" washers at present come from Canada. As our readers are already aware the company either controls or is associated with a large number of separate companies.

The factory is divided into two parts. The larger part is a single-storey building entirely devoted to the production of the "Zeros" refrigerator which we are informed are being made at the rate of 150 to 200 per day. A detailed description of the construction and operation of this refrigerator, which utilises the "Normelli" dry-absorption system, appeared in our issue of April 12th, 1935 (p. 531).

Under the guidance of Mr. Normelli we visited the main shops where, in addition to various components, all the tools required are constructed. Adjoining this department is a room containing vacuum cylinders to extract the moisture from the calcium chloride, which is then ready for insertion in the generator absorbers. After assembly, testing and filling, the units pass on for saturation with ammonia. The cold storage boxes, &c., are then attached and the completed units boxed and lagged with granulated cork.



An aerial view of the works of Messrs. Ismay Industries, Ltd., Dagenham, and sections of the refrigerator department

In the press shop all the cases and interior cabinets are made, the various sections being welded together. The cases are chemically cleaned and bonderised before being given a priming coat and several coats of enamel. The interiors are vitreous enamelled, the latter process not as yet being done on the premises. All the necessary carpentry is carried out in large woodworking shops. After assembly of the cases the refrigerating units are inserted, the wiring completed, and the chromium-plated fittings attached. The finished article then goes to one of the asbestos walled test rooms where it is tested in a constant temperature of 87 deg. F. When tests have been completed the refrigerators are packed and taken to the dispatch room which is at present undergoing improvement and enlargement.

We were then shown an interesting film demonstrating the whole process of manufacture both at Dagenham and also in Germany, where, we were told, the Siemens-Schuckert Co. also employs the Normelli system.

Vacuum Cleaners and Radio Sets

The main portion of the other section of the Dagenham factory is a four-storey building, the whole of the ground floor being used as stores and for the Service Department. On the floor above we had an opportunity of seeing some of the new model "Electrix Dustflow" vacuum cleaners in course of construction and testing. Seven different nozzle and brush attachments are included in the equipment, a swivel nozzle being particularly useful for cleaning under low furniture. In the "Super" model a deodorising device sterilises the dust in the bag and purifies the air, while a "de-mothing" attachment is also provided. All metal parts are earthed.

On the same floor we saw "Blue Spot" loud speakers in various stages of construction. The production of "Halcyon" radio receivers occupies the whole of the second floor, where we learnt that a number of new models would shortly be put on the market. The third floor is utilised for the radio chassis and vacuum cleaner assembly. "Straight-line" production is employed throughout the factory.

Low-voltage Neon Tubing

Adjoining this building is a large one-storey foundry where many of the components required in the manufacture of the refrigerators, vacuum cleaners, etc., are made. General offices, drawing offices, and a research section occupy the central block, at the rear of which is the factory of Messrs. John Ismay (Neon Signs), Ltd. Here we were shown some of the low-voltage neon signs, operating on a 240-V a.c. supply, which the company has just placed on the market in standard letters 10 in. high and in curves or straight sections 30 in. in length. The method of construction enables the tubing to be bent into the form of the letters without the need of "double-backs" and "blacking-out," and an important feature is that a temporary disablement of a letter or section does not affect the brilliance or operation of the remainder of the display. The colours available are light green, yellow and white in opal tubing; and dark green, blue and indigo blue in clear tubing.

To meet the demand for a simple interior letter sign which can be easily altered, the company makes a low-voltage neon expanding unit sign of 14/15-mm. gauge tubing in standard 5-in. letters. Mounted on separate standard boxes, these letters are coupled together by simple nuts and bolts which also form the electrical connections. For none of the Ismay low-voltage neon tubes are any transformers, energisers or coils utilised.

Electric Clock Manufacture

Plant has just been installed in another building for the manufacture of electric clocks of various types. The plates are of 16-gauge brass, and machine-cut gears are used throughout. The 1.9-W motor is noiseless, and the movements are supplied with various fittings, including two different styles of bakelite moulded backs, with indicators or with gears for central-sweep seconds hand and with one-hole central fixing.

One of the associated Ismay companies, the Kniveton Cable Works, Ltd., is shortly to start the manufacture of cables at Dagenham, while it is expected that the Trutolife Television Co., Ltd., will be ready for the British Broadcasting Corporation's high-definition television transmissions when they commence.

New Books

Physics. By E. HAUSMANN and E. P. SLACK. Pp. 776; figs. 470. London: Chapman & Hall, Ltd. Price 20s.

Recent books on elementary general physics have tended to neglect the classical foundations of the subject in order to devote more space to modern developments. This book is, in this respect, sanely reactionary. In particular, the treatment of physical mechanics is extensive and satisfactory, taking up in all over one-third of the seven hundred odd pages; this includes, in addition to what is usually given in a first course, sections on rigid dynamics, elasticity and liquid motion. As presented, they are made to appear not inherently difficult.

The sections on heat are less extensive, but comprehensive; they contain, for example, on the theoretical side an account of the work scale of temperature, and on the practical side a description of the internal combustion engine. Electricity and magnetism (200 pages) cover the usual ground. The authors illustrate electro-magnetics rather extensively from machinery, and there is a section on electrical communication. That interesting and instructive machine, the Van de Graaff electrostatic generator, is described, and Millikan's oil-drop experiment is appropriately introduced. Sound does not occupy much space, but what is given is good. The authors do not shirk the fact that here, for a proper understanding of the subject, a little mathematical analysis is necessary, and they have shown good discrimination in omitting much modern descriptive matter. The section on light (including one chapter on radiation and atomic structure) strikes a good balance between geometrical and wave optics.

The chief fault of the book is the lack of sharpness of a good number of the illustrations; this may, however, be a flaw in the individual copy which we have seen. Altogether, it is a decidedly good text of about Intermediate B.Sc. standard. Its detail and worked examples will make it particularly useful to a student working alone.

The Surface Condenser. By B. W. PENDRED. Pp. 144; figs. 68. London: Sir Isaac Pitman & Sons, Ltd. Price 8s. 6d.

This work is described by its author as a "Survey of Modern Condensing Practice." The introductory matter, while admirable for the most part, contains statements which might be misleading to the uninitiated. Progress in design is said to have resulted in the pressure drop through the tube nest on the steam side falling from about one inch to half or one-third of that figure; actually, the steam pressure drop has been reduced to the order of hundredths of an inch Hg. Also, in discussing condensate temperature and pressure drop, the author does not refer specifically to the part played by air-pump performance in making it possible to maintain the condensate temperature very close to the temperature corresponding to vacuum, so that the non-expert might draw the conclusion that tube arrangement was the dominant factor, whereas, while rational tube arrangement is a contributing factor, air-pump performance is the main factor in realising the highest possible condensate temperature with a given absolute pressure. Modern forms of air pumps are able to maintain the partial pressure of the air at the point of air withdrawal at a very low value, whereas the old reciprocating type caused an inherent loss of from half to one inch Hg. of vacuum, or, alternatively, a heat loss in the condensate corresponding to the loss given. We would suggest that the two factors outlined ought to be dealt with separately and their respective effects clearly defined.

No mention is made of the heat-balance method of calculating the quantity of circulating water originated by Mr. W. M. Selvey which, without undue test refinements, gives results within reasonably close limits of accuracy. Incidentally, the method gives the amount of heat rejected to the condenser, also with reasonable accuracy.

The chapter on down-flow condensers is good and gives a comprehensive outline of all the leading makers' arrangements. It indicates clearly the reasons underlying tube arrangement design. The Ginabut arrangement of tangential fall of the condensate is outlined and the claims stated in detail, but the author does not comment on the claims, about which engineers differ.

Chapters on inverted condensers and radial flow condensers include a reasoned analysis of the various formulæ for calculating the mean temperature difference between steam and water, also a clear statement of the reasons for departures from ordinary practice. Special designs of condensers for various purposes are also discussed.

Air coolers and air ejectors are dealt with adequately. Sir Charles Parsons is mentioned as the first in this country to use a steam jet for air extraction—in his "vacuum augmentor." As a matter of fact, Parsons's augmentor in series with an ordinary reciprocating air pump gave as good a vacuum as a modern air pump as it provided the means of obviating the inherent loss which was common to all types of reciprocating bucket air pumps, and is another tribute to his genius.

The water side is treated thoroughly, and the effect of water velocity on heat transmission adequately outlined, together with the effect of tube entrance shape on resistance, siphonic systems and cleaning of tubes.

In the chapter dealing with pressure, temperature and heat distribution the author deals with the claim put forward for the "regenerative condenser" that certain designs obtain a condensate temperature higher than that corresponding to the pressure in the condenser at the steam inlet. This claim contravenes known physical laws which have never been seriously challenged, and the author suggests that it is probably based on inaccuracies of test observations. The "rate of heat transmission as a criterion of performance" is submitted to a first-class analysis.

The book is well written in a clear style, and reveals an author with a good grasp of the subject, with an analytical unbiased mind.

National Electrical Code Handbook. By A. L. ABBOTT. London: McGraw-Hill Publishing Co., Ltd. Price 18s.

The National Electrical Code is the American equivalent of our I.E.E. Regulations. Both of these classic sets of rules and recommendations are revised from time to time and each needs a good deal of explaining to the practical men who are presumed to fulfil their several enactments.

This handbook, of 547 closely printed pages, is designed to give a comprehensive grasp of National Code requirements and presents detailed discussions and explanations of the classified rules. It has attained its third edition and is based on last year's issue of the Code. American installation materials and methods differ very much from those generally used in this country, and practice, as this handbook reveals, is in some ways crude to our notions. The drier atmosphere probably favours the life of unprotected cables and of pressed and stamped light-gauge gadgets which would soon prove troublesome here. The great range of voltage and variety of service systems and the heavy currents demanded by supplies as low as 110 V, give special interest to American Code explanations, so that this popular illustrated handbook is well worth the study of all concerned with the many problems which arise in installation work everywhere. It is of value also in affording information regarding standardisation and inspection methods in a country where these are more complete and advanced than in our own.

* * *

Shorter Notices

In the second volume of "Reports on Progress in Physics" edited by Mr. A. Ferguson and published by the Physical Society (pp. 371; figs. Price: 21s. to non-fellows), the varied aspects of progress in physics are dealt with by authorities in the particular branches. The Physics Department of the National Physical Laboratory contributes the section dealing with X-rays, and that on electron tubes is edited by Prof. G. I. Finch, while Mr. L. Hartshorn considers recent researches in electrical and magnetic measurements. Other chapters deal with general physics, the quantum theory, atomic physics, geophysical prospecting, radio exploration of upper-atmosphere ionisation, sound and heat and sections on spectroscopy and optics.

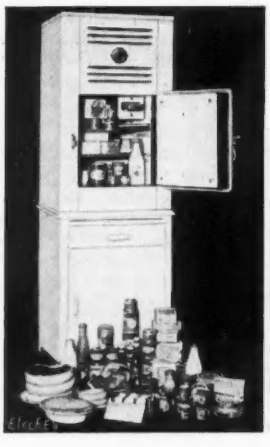
"The Structure of Metals and Alloys." By W. Hume-Rothery. (Pp. 120, 61 illustrations.) London: Institute of Metals. 3s. 6d. post free.—This is the first of a new series of monographs and reports on metallurgy. It attempts to indicate what a metal or alloy really is, in terms of its crystalline structure with an electronic background. It is as easy reading as the subject permits, not being overladen with detail and containing no higher mathematics. Each chapter has its bibliography of selected references, and an index is provided. It is to be hoped that subsequent additions to the series will be equally commendable.

"Soviet Science," by J. G. Crowther. Pp. 342; illus. London: Kegan Paul, Trench, Trubner & Co., Ltd., Price 12s. 6d. net.

"Wire-Drawing and Cold Working of Steel," by A. T. Adam. (Second edition.) Pp. 160; figs. 67. London: H. F. & G. Witherby. Price 35s.

"Electric Wiring," by A. A. Schuhler. (Third edition.) Pp. 387; figs. 305. London: McGraw-Hill Publishing Co., Ltd. Price 15s.

"L'Electricité sans Algèbre," by A. Soulier. Pp. 462; figs. 164. Paris: Librairie Garnier Frères. Price 15 fr.



A 2¼ cu. ft. "Zeros" refrigerator mounted on a kitchen cabinet, and the new "Electrix" vacuum cleaner. (See preceding page)

Domestic Appliances in the United States

IN the *Bulletin* of the Edison Electric Institute for March Mr. W. M. Carpenter sums up the results of a questionnaire regarding the use of domestic electrical service in the United States. Estimates are given of the proportion of installed appliances which are in regular use and of the average amount of electricity used by these during the course of 1935. Some difficulty was experienced in arriving at the facts for various reasons, one or two of which are the subject of comment in a leaderette on page 554. However, it is thought that it has been possible to establish a set of averages which are sufficiently conservative to fit the figures of electricity actually sold.

The average of the past two years is taken, and it is shown that, in numbers, electric irons head the list, their total being 19,400,000. Of these 80 per cent. were estimated to be in active use; their average annual consumption was 80 kWh, giving a total consumption of 1,241.6 million kWh. The same percentage of the 19,250,000 radio sets installed consumed an average of 100 kWh—a total of 1,540 million kWh.

The largest individual consuming appliance was the water heater, which averaged 3,000 kWh. There were, however, only 75 per cent. of the 320,000 installed in active use, giving a total consumption of 720 million kWh. The largest total consumption is shown against refrigerators, of which there were 6,535,000. The average consumption of the 90 per cent. in regular use was 480 kWh—a total consumption of 2,823.36 million kWh. Ranges (cookers) numbered 1,135,000, of which 85 per cent. were in active service; the average consumption was 1,500 kWh, and the total for this class 1,447.5 million kWh.

A type of appliance unfamiliar in this country is the electric oil burner. There were 912,000 of these, and the high proportion of 95 per cent. were in active use. The average consumption was 225 kWh, and the total 194.94 million kWh. The grand total of appliances in active service in United States homes was 20,779,100, and their total consumption 13,978 million kWh.

The same article also deals with the use of electricity by consumers, and a table is included giving figures for the past nine years. From this it is seen that in 1928 the average consumption per customer was 443 kWh and the average price 6.82 cents per kWh. Of this refrigerators accounted for only 17 kWh and radio for 2 kWh. In 1935, however, the average consumption was 673 kWh, of which refrigerators took 136 kWh and radio 74 kWh. The average price was 5.03 cents per kWh.

Commenting on these figures, Mr. Carpenter says: "It is commonly assumed by almost everybody, both within and without the industry, that reduced rates automatically and of themselves bring an equal compensation in increased use. Yet here we have the unmistakable evidence that two appliances, in whose purchase the question of electric rates plays only a very minor part, have constituted the entire increase which has taken place since 1930, and the net result of everything else has been no gain at all."

Japan's New Electricity Policy

WITH the object of providing abundant supplies of electricity at cheap rates the Japanese Government is adopting a policy which will give it practically complete control of the electric power industry. The question has been studied by the Investigation Board of the Japanese Cabinet, and it is expected that the Government will endorse the plan drafted by the authorities who have had the subject under consideration, after slight amendments have been made in the light of the Board's recommendations.

The essential points of the two plans drafted by the Board of the Cabinet and the Ministry of Communications are given below :—

(1) To adopt administrative measures to govern the electricity supply industry, with a view to placing it under State ownership and management at some future date. Under present financial circumstances it is impossible for the State to take over an industry in which over 5,000,000,000 yen is invested.

(2) To strengthen the control of the electricity supply industry so that the Government may be able to take active measures to guide the industry in accordance with plans drafted from the national standpoint, instead of leaving the matter in the hands of industrialists.

(3) Generation and transmission plans to be drafted by the Government from the national point of view, instead of by private interests.

(4) The charges for electric power and lighting should not be fixed in accordance with the cost of production, but some method should be adopted to equalise the rates in the cities and provincial districts, and to reduce them to the lowest possible level.

(5) The monopoly existing to-day is believed by the authorities to be opposed to consumers' interests, and should therefore be abolished.

(6) To set up thermal generating plants in important cities in order to minimise the risk from natural calamities, and also to prevent electricity producers raising their rates to exorbitant figures.

(7) To adopt a system under which supply companies shall be required to secure the Government's approval to their rates of dividend.

(8) To adopt a special system under which the Government shall be authorised to interfere with the management of supply companies, to induce them to accumulate a substantial portion of their undivided profits for the strengthening of their financial position.

Ceylon's Electrical Imports

LAST year the United Kingdom continued as the chief supplier of Ceylon's electrical needs, with the United States (mainly in radio apparatus) and Germany taking a small part. The following table, which is based on the recently-issued official returns, shows the value in thousands of rupees (rupee =1s. 6d. at par) of the principal electrical imports last year with a note of increases or decreases compared with 1934. The total value of imports of electrical apparatus and machinery last year was 2,424,000 Rs. in value as compared with only 1,728,000 Rs. in 1934 :—

	1935. Rs. (Thous.).	Inc. or dec. Rs. (Thous.).
Control and switchgear—		
Total*	48	+ 9
Radio instruments and apparatus—		
Total	192	+ 50
From United Kingdom	96	+ 1
„ Germany	4	— 2
„ Holland	18	+ 4
„ United States	70	+ 49
Other telegraph and telephone instruments—		
Total*	59	+ 18
Lighting accessories, fittings and switches—		
Total	232	— 51
From United Kingdom	70	— 1
„ Germany	37	+ 16
„ Japan	21	+ 4
„ United States	38	— 5
Batteries, dry—		
Total	311	+ 41
From United Kingdom	34	+ 16
„ United States	121	— 12
„ Germany	4	— 1
„ Hong Kong	149	+ 39
Other batteries and accumulators—		
Total*	47	—
Rubber insulated wires and cables—		
Total	190	+ 41
From United Kingdom	168	+ 39
„ Germany	17	+ 3
Other elec. wires and cables—		
Total	303	+ 228
From United Kingdom	297	+ 228
„ Germany	4	—
Lamps, gas-filled—		
Total	79	+ 29
From United Kingdom	69	+ 25
Elec. lamps, other—		
Total	47	+ 20
From United Kingdom	28	+ 9
„ Japan	10	+ 8
Torch bulbs—		
Total	34	— 11
From Japan	8	— 5
„ United States	26	— 5
Elec. goods and apparatus n.e.s.—		
Total	407	+ 120
From United Kingdom	355	+ 109
„ Germany	16	— 2
„ Japan	6	— 1
„ United States	19	+ 12
Transformers and convertors—		
Total	38	+ 25
From United Kingdom	32	+ 20
„ United States	5	+ 5
Generators and alternators—		
Total	77	+ 8
From United Kingdom	69	+ 3
„ United States	8	+ 8
Motors—		
Total*	64	— 8
Elec. machinery not elsewhere specified—		
Total	298	+ 192
From United Kingdom	286	+ 197
„ Germany	3	— 1
„ Italy	2	—
„ United States	5	+ 1

* Mainly from United Kingdom.

Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

Lighting of the "Stirling Castle"

The new Union Castle liner *Stirling Castle* naturally incorporates the very latest ideas in lighting practice, and has over 10,000 "Mazda" lamps installed, including a large number

A writing room on the "Stirling Castle," illuminated by "Mazda" light tubes

of "Mazda" light tubes. Throughout the ship extensive use has been made of these light tubes, mainly without fittings. Special attention has been given to the decorative schemes, and many original effects of colour combination and design contribute to the general beauty. The decorations and furnishings have been carried out by Heaton Tabb & Co., Ltd., who were also responsible for the lighting schemes. A system of indirect lighting has been adopted in some of the public rooms, and around this the decorative effects have been built. In many cases "Mazda Longlite" lamps are installed, the dining saloon being equipped with an artistic and symmetrical arrangement of these lamps in specially designed chromium fittings.

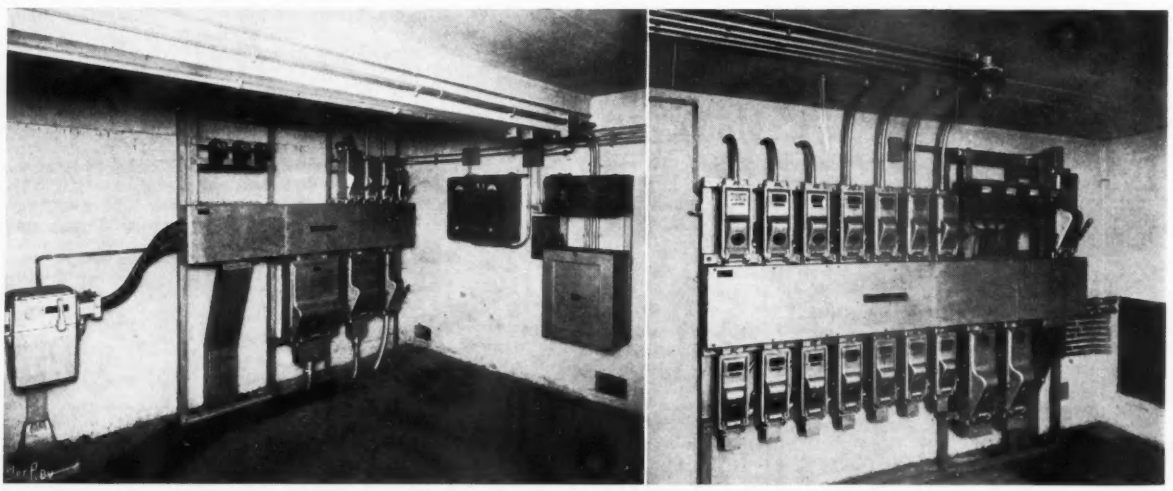
Recent Orders

In addition to the 3,500-b.h.p. Diesel engine on order from the Bermuda Electric Light, Power & Traction Co., Ltd., the English Electric Co., Ltd., has just received the following contracts for Diesel generating sets: Three 1,000-b.h.p., 8-cylinder Diesel engines and alternators for installation in Australia; two 1,500-b.h.p. English Electric Fullagar Diesel engines and alternators for the Surat Electricity Co., Ltd., India; three 750-b.h.p. and one 300-b.h.p. Diesel engines, together with special d.c. generators, for Messrs. Henry Boot for the Pinewood Studios, Iver, Bucks; one 750-b.h.p., 6-cylinder Diesel engine and d.c. generator for a three-wire system for the Aberystwyth Corporation electricity works; and two 400-b.h.p., 8-cylinder, "K" type Diesel engines, which will be employed for direct coupling to alternators for supplying electricity to very important paper mills in Canada, the alternators being manufactured by the English Electric Co. of Canada, Ltd., at its works at St. Catharine's, Ontario.

International Combustion, Ltd., has received an order for additional oil firing equipment for the ten existing boilers which are now operating on the "Lopulco" pulverised coal system at the New Port power station, Buenos Aires. The design of the oil firing is such that the boilers will be able to be fired by means of coal or oil, no alterations to the combustion chambers being necessary. The present contract comprises the supply of all essential equipment, including special vertical burners and control plant apparatus. Repeat

A Technical School Installation

TO handle the electricity supply required for the recently opened extension of the London County Council's School of Building in Ferndale Road, Brixton, the electrical contractors, Messrs. Buchanan & Curwen, Ltd., have provided an intake chamber and switchroom the layout of which is particularly neat. Entering the room from the County of London Electric Supply Co.'s adjoining transformer chamber, the cables carrying the 400-V, 3-phase, 50-cycle a.c. supply are taken to the main switchboard, where separate ironclad switch-fuses control the circuits to the masonry and woodworking shops, ventilator motors, cinematograph apparatus, printing arc and the power sub-distribution board. On the opposite wall is a separate lighting and heating switchboard, the top half of



Left: The main switchgear, rectifier and automatic telephone equipment at the London County Council's School of Building, Brixton. Right: The lighting and heating switchboard

which is used for the new building and the lower half for the old. The same room also houses a Siemens automatic telephone installation and a Westinghouse rectifier required for charging the batteries for the fire alarm and fifty-six Smith's clocks installed in various parts of the building. Many new electrically operated machines and tools have been supplied for the woodworking and masonry shops by Messrs. Wadkin & Co., J. Sagar & Co., Ltd., Flextol Engineering Co., Ltd., and Anderson, Grice & Co., Ltd. English Electric and Crompton Parkinson motors are employed very extensively, and most of the larger ones are fitted with Allen West or E.C.C. push-button starters. Laylights, with Siemens tubular lamps concealed behind the cross-beams, provide the main illumination for the large new entrance hall. These lamps, as well as several attractive oxidised bronze ceiling and wall bracket fittings, are controlled from the porter's lodge just inside the entrance. During the alterations the opportunity was taken to rewire and retube most of the old building, and the illumination of the main hall has been much improved by the provision of several pendants containing 500-W lamps, together with spherical fittings under the galleries. Most of the lighting fittings installed were supplied by Messrs. Benjamin Electric Co., Ltd., and Falk, Stadelmann & Co., Ltd. In spite of the extensive alterations to the wiring classes have had electric lighting available the whole time. We are indebted to the school authorities for their assistance in compiling these notes and permission to take the photographs, which we reproduce.

orders have been received for "L" type travelling grate stokers from Messrs. Tullis Russell & Co. and Croydon Corporation electricity works. The stoker for Tullis Russell will have a grate area of 297 sq. ft. and will be installed under a boiler having a maximum evaporation of 50,000 lb. per hr. This order includes arches and secondary air. The Croydon Corporation stoker will have a grate area of 510 sq. ft. firing a boiler of 175,000 lb. per hr. maximum evaporation. This will be the fourth International unit to be installed at this power station.

Rapid progress is being made with the electrification of the Southern Railway's main line to Portsmouth, and the following contracts for apparatus required in connection with this extension have been placed:—Thirty 2,500-kW steel tank rectifier equipments, complete with transformers, with Bruce Peebles & Co., Ltd.; thirty 4,000-A high-speed circuit-breakers and 262 2,500-A high-speed circuit-breakers with the British Thomson-Houston Co., Ltd.; and thirty sets of 33,000-V switchgear equipments, thirty sets of l.p. gear, and thirty sets of supervisory control apparatus with Asea Electric, Ltd.

The I.M.E.A. Convention Exhibition

The electrical exhibition which is being arranged in connection with the I.M.E.A. Convention in Edinburgh from June 8th to 12th should prove of even greater interest than its predecessors to judge from the list of exhibitors. This list is reproduced below:—

Aidas Electric, Ltd.
Arch. Low Electrics, Ltd.
Arrow Electric Switches, Ltd.
Automatic Electric Co., Ltd.
Automatic Light Controlling Co., Ltd.
Baldwin, H. J., & Co., Ltd.
Bastian & Allen, Ltd.
Belling & Co., Ltd.
Benjamin Electric, Ltd.
Berry's Electric, Ltd.
"Besst" Electrics, Ltd.
Bray, Geo., & Co., Ltd.
British Elec. Meters, Ltd.
British Insulated Cables, Ltd.
British National Electrics, Ltd.
British Sangamo Co., Ltd.
British Thermostat Co., Ltd.
British Thomson-Houston Co., Ltd.
Bruce Peebles & Co., Ltd.
Bulpitt & Sons, Ltd.
Burnley Components, Ltd.
Cable Covers, Ltd.
Cable Makers' Association.
Callender's Cable & Construction Co., Ltd.
Carron Company.
Corfield-Sigg, Ltd.
"Diamond H" Switches, Ltd.
Drake & Gorham Wholesale, Ltd.
E.C.A. of Scotland.
E.D.A.
Edinburgh Corporation.
Edison Swan Electric Co., Ltd
Electric Vehicle Committe.
Electrical Apparatus Co., Ltd.
Electrical Assoc. for Women.
Elec. Industries Benevolent Association.
Elexcel, Ltd.
E.L.M.A. Lighting Service Bureau.
English Electric Co., Ltd.
Enk Manufacturing Co., Ltd.
Eureka Vacuum Cleaner Co., Ltd.
Evershed & Vignoles, Ltd.
Falk, Stadelmann & Co., Ltd.
Falkirk Iron Co., Ltd.
Ferranti, Ltd.
Geo. Green & Co.
General Electric Co., Ltd.
Greene Philips & Co.
Hawkins, L. G., & Co., Ltd.
Heatrae, Ltd.
Hoover, Ltd.
Hotpoint Elec. Appliance Co., Ltd.
Harland Eng. Co., Ltd.
Hague & McKenzie, Ltd.
H.M.V. Household Appliances, Ltd.
Horstmann Gear Co., Ltd.
Harcourts, Ltd.
Holophane, Ltd.
Hurley Machine Co., Ltd.
Iddon, Victor H., Ltd.
Johnson & Phillips, Ltd.
Jackson Elec. Stove Co., Ltd.
J.P. Tubular Heaters, Ltd.
M. & C. Switchgear, Ltd.
Moffats, Ltd.
Metropolitan-Vickers Electrical Co., Ltd.
MacGregor & McCallum, Ltd.
Macpherson, Donald, & Co., Ltd.
Measurement, Ltd.
Parsons, C. H., Ltd.
Premier Electric Heaters, Ltd.
Parmiter Hope & Sugden, Ltd.
Reyrolle, A., & Co., Ltd.
Radiovisor Parent, Ltd.
Revo Electric Co., Ltd.
Rheostatic Co., Ltd.
Santon, Ltd.
Siemens Elec. Lamps & Supplies, Ltd.
Silvagrey Electric, Ltd.
Simplex Elec. Co., Ltd.
Stokes Appliances, Ltd.
Tricity Cookers, Ltd.
Tucker, J. H., & Co., Ltd.
Unity Heating, Ltd.
Venner Time Switches, Ltd.

The "Nesco" Year Book

A number of illustrated articles describing the various industries to which the company gives an electricity supply are included in the "Nesco Year Book for 1935" (North-Eastern Electric Supply Co., Ltd.). This interesting publication also shows the company's activities in the domestic sphere and contains a full report of the annual meeting held on March 17th last.

The stand of the Hotpoint Electric Appliance Co., Ltd., at the Ideal Home Exhibition

New L.E.P. Club House

The new club house at Blackrod of the social and athletic organisation of the staff of the Lancashire Electric Power Co. (the M.M. Club) was officially opened by Mr. C. D. Taite (engineer and manager) on April 4th. After declaring the building and bowling green open Mr. Taite, on behalf of members of the club, presented a silver trowel and mallet to Mr. R. C. Leslie, chairman of the Club Committee, after which Mr. Leslie, the company's mains superintendent, who played a leading part in the founding of the club, laid a stone inscribed with his name. About 250 members and visitors sat down to tea in the marquee, at the conclusion of which Mr. Leslie made a brief speech, thanking the many friends of the company for their active support which had made possible the opening of the club. He then expressed appreciation to Mr. Taite, who had always given him a kindly word of encouragement and advice in connection with the club movement. Mr. Taite, in responding, mentioned that already the club had forty associate members and 220 ordinary members, and £546 had been raised by subscriptions.

Mr. C. D. Taite opening the new premises of the social and athletic club of the staff of the Lancashire Electric Power Co.

Trade Announcements

Mr. J. Freeman, electrical and radio engineer, of 182, High Street, Dudley, has opened additional showrooms at 36, High Street, Brierley Hill.

The Electro Dynamic Construction Co., Ltd., has removed to St. Mary Cray, Kent (telephone: Orpington 2560-1).

Mr. J. Wood, electrical contractor, of Bagnall Road, Milton, Stoke-on-Trent, has opened new showrooms at 138, Leek Road, Milton.

M. & C. Switchgear, Ltd., has opened a district office at the Sun Chambers, 32-34, Kennedy Street, Manchester, under the charge of Mr. Turner, M.I.E.E.

For Sale

Messrs. Henry Butcher & Co. will sell by auction on May 7th electrical plant and equipment.

(See our classified advertisements.)

The Merseyside Society of Inventors

The Merseyside Society of Inventors has been formed in Liverpool as a result of a movement to form a central organisation through which ideas could be developed collectively and action taken to further or safeguard local inventive talent. Although the specific purpose of the society is to assist the inventor, it has evolved a scheme of co-operation with industry, and particulars of this scheme can be obtained on application to Mr. R. G. Norris, hon. secretary, 67, Moscow Drive, Liverpool.

Change of Address

The South-West Midlands Advisory Joint Committee has removed to 27, Temple Street, Birmingham.

A Works Lighting Installation

With reference to the note which appeared in our April 3rd issue, page 505, relating to the lighting installation at the works of the Philco Radio & Television Co., Ltd., at Perivale, Messrs. William Steward & Co., Ltd., inform us that they prepared and carried out this lighting scheme.

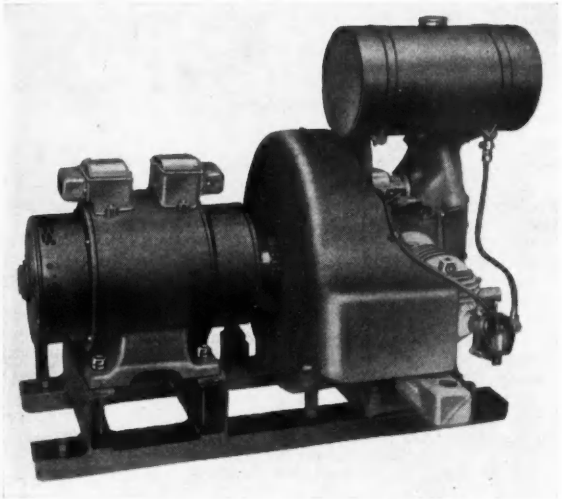
Electrical Licensing in Michigan

We have received from the Electrical Administrative Board of the State of Michigan a copy of an Act passed last year which in the terms of its title provides "for the licensing of electricians and electrical contractors; the supervision and inspection of electrical wiring; the adoption and enforcement of minimum standards therefor, by an electrical administrative board; and to provide penalties for violations of this Act." The Act has thirteen sections, and sets forth the methods to be

adopted by the Board in appointing inspectors and licensing electrical contractors and journeymen. The minimum standards which it is to lay down are to be " not less than the minimum standards prescribed by the national electric code." The operation of the Act is apparently confined to smaller installation work. The exceptions include " minor repair work, the replacements of lamps, and the connection of portable devices to suitable receptacles which have been permanently installed "; telegraph and telephone work; lifts and hoisting machinery; and theatre equipment. There are three classes of licence, renewable annually: The Class I electrical contractor's licence, costing $25, is applicable to employers of labour; the Class II electrical contractor's licence ($5) is for contractors who do not employ journeymen; and the Class III licence ($1) is for wiremen. The Board has five members, including representatives of the employers and employés of the industry and of the fire underwriters. The members are not paid, but they are reimbursed their " actual and necessary " expenses. The Act provides for fines and imprisonment for violation of its provisions, the maximum being $50 or thirty days.

An Arctic Expedition's Generating Set

The Oxford University Arctic expedition set out in July, 1935, for the unknown coast between Extreme Hook and Cape Leigh Smith in North-East Land. The main objects of the



A Petter engine for service in the Arctic

expedition were exploration, survey and the study of glaciology. For use in connection with a radio transmitter for ionosphere observations, the expedition carried with it a 2-h.p. single-cylinder petrol engine manufactured by Petters, Ltd., directly coupled to a 1-kVA, 240-V alternator by Lancashire Dynamo and Crypto, Ltd. The driving and driven units are mounted together on a steel channel baseplate, as shown in the accompanying illustration. Air cooling is provided by means of a flywheel centrifugal impeller, giving a strong air flow to the cylinder and cylinder head which have large fans scientifically arranged. To prevent electrical interference a screened ignition system is used. The engine is force lubricated from an enclosed camshaft-operated pump, and a strainer is embodied in the circuit, enabling the oil to be re-used.

A South African Merger

An agreement has been concluded for the amalgamation of H. Polliack & Co., Ltd., and Mackay Bros., Ltd., two leading South African dealers in musical instruments, electric refrigerators, and electric cooking appliances. The companies will continue to operate separately under their present names, but they will be under joint management. Large extensions of the businesses are contemplated in South Africa, Rhodesia, and South-West Africa.

Prices of Materials

Messrs. Henry Gardner & Co., Ltd., report, April 15th: No change in the price of copper bars (best selected), sheet and rod. English pig lead £18, 5s. decrease. Spelter £15 18s. 9d., 11s. 3d. increase. English block tin £210 10s., £4 5s. decrease.

Messrs. Edward Till & Co. report, April 15th: No change in the price of India rubber, Para fine.

Large Extensions at Liverpool

The Liverpool City Council has approved recommendations by the Clarence Dock Power Station Committee for the acceptance of tenders for new plant at the power station. Messrs. Henshaw & Sons, Liverpool, receive the contract for the erection of a reinforced concrete chimney and downcast chamber at a cost of £25,794; the contract for the supply of two water tube boilers at a cost of £145,000 goes to Messrs. Babcock & Wilcox, Ltd.; while the Metropolitan-Vickers Electrical Co., Ltd., is to supply a 50,000 kW turbo-alternator set at a cost of £178,844.

Registered Electrical Contractors

We have received from the National Register of Electrical Installation Contractors, 2, Savoy Hill, London, W.C.2, a directory of those whose names are on the Register arranged in both geographical and alphabetical order. This should prove a useful guide to those having installation work to place. Combined with the directory is a reprint of the report on inspection which was embodied in the Executive Committee's report for 1935 and reviewed in our April 3rd issue.

At the last meeting of the Executive Committee of the Register the following applications for registration were accepted:—

Seddon, G., Ardwick, Manchester, 12.
Hutchinson, T., Hartlepool.
Ellis, R. P., Aberavon, Port Talbot, Glam.
Dagnalls (Radio & Electrical), Ltd., Sparkhill, Birmingham, 11.

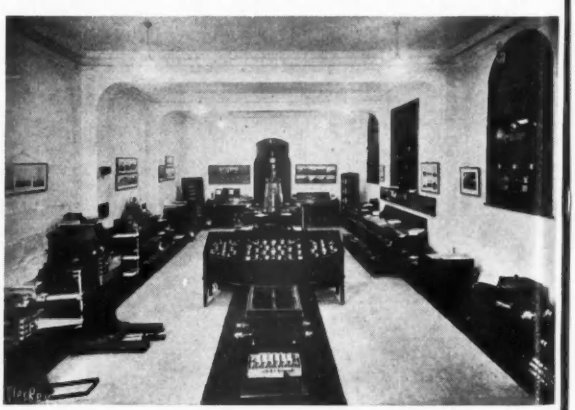
At the same meeting two applications were declined.

Electricity Workers' Hours and Wages

At the request of the Minister of Labour the employers' side of the National Joint Industrial Council and National Joint Board for the Electricity Supply Industry has prepared a report upon the effect of a reduced working week for the industry, in which it states that it is unable to recommend a reduction of hours. It is pointed out that the staff and employés in this industry enjoy salaries, wages, and working conditions more favourable than those prevailing in the industries of the country generally, and it is of opinion that it would be inequitable if any increased cost were imposed on any class of consumer in order to place the staff and employés of the industry in an even more favourable position. The report states that the number of men on the technical and manual-worker staffs of the industry is 57,000, and that if a 40-hour week were adopted it is estimated that under the present system of working it would be necessary to increase the number by 15.70 per cent., an increase of 8,949 men. The increase of salary and wages cost of a 40-hour week for thirty-six undertakings which furnished information would be £603,610, or 16.12 per cent. on the present cost. For the whole of the industry the total increase would be £1,530,839 per annum, which would bring the total salary and wage costs up to £9,496,519. The disparity of wages between this and other industries would be so great that the majority of the electricity undertakings would cease to carry out work by direct labour and would let it out to contract. This would diminish the number of permanent employés working under the favourable conditions that operate in the electricity supply industry, a consequence highly undesirable and not in the best interests of the men.

A New B.I. Showroom

The demonstrations of electric welding arranged at Leeds by British Insulated Cables, Ltd., are attracting considerable interest. B.I. electric welders form a part of a comprehensive range of manufactures which are displayed in the newly equipped showroom at 89, Cookridge Street, Leeds. The opening of this showroom is a continuation of the policy of hold-



The new B.I. showroom at Leeds

ing periodical displays of B.I. manufactures which has proved successful in London, Glasgow, Newcastle-on-Tyne, Birmingham and Sheffield.

Eastbury Manor House, Barking

Eastbury Manor House, Barking, a fine example of Tudor architecture built in the latter half of the sixteenth century, was recently purchased by the National Trust with the aid of the Society for the Protection of Ancient Buildings and has been placed at the disposal of the Barking Corporation. The house has been converted into an excellent and interesting museum. The restoration and conversion of the building raised the question of a comprehensive scheme of lighting and heating in lieu of the ineffective gas installation and the original Tudor fireplaces. The Museum Committee considered the lay-out and specification prepared by Mr. W. E. Kidner,

A.M.I.E.E., borough electrical engineer, Barking, and decided to use electricity for both lighting and heating. The former being an obvious choice and the latter becoming equally obvious by reason of the low cost of installation, cost of operation, and by reason of two further factors of importance when dealing with a building of great historical interest, *viz.*, that an electrical heating system could be installed with the minimum

One of the rooms of Eastbury Manor House, Barking, showing the lighting arrangements and the tubular heating

of structural alteration and with the risk of fire eliminated. The lighting installation consists of sixty-two general lighting points with 14-in. enclosed pendant fittings and 200-W lamps, twenty-one lighting points for corridors, staircases, stores, &c., and forty-five multi-way sockets suitably placed for picture lighting, imitation coal fires, and local lighting. The switches for the lighting points in the parts of the house open to the public are in four groups, mounted in oak boxes constructed to harmonise with the surroundings as far as possible. The "Unity" tubular system with thermostatic control was chosen for the heating of the rooms. The installation consists of 101 tubular heaters, having a total length of 1,118 ft. and a maximum load of 67 kW. Energy is charged for at a flat rate of 0.675d. per kWh. These heaters are controlled by means of twenty-seven thermostats and a temperature of 60° F. is provided throughout the building with the exception of the hall and the landing, which are heated to 55° F.

New Catalogues and Lists

Searsint, Ltd., 1, Thames House, Millbank, London, S.W.1.—Leaflets and booklets dealing with "Coldspot" refrigerators and "Kenmore" electric washers and vacuum cleaners.

Bertram Brice, Cliffdown Works, 42, Castle Hill Road, Hastings.—A pamphlet describing airing and drying cabinets and the "Bristove" heater.

Bowen Instrument Co., 9, Newton Road, Leeds, 7.—Particulars of the "Bowen Pyroreg" automatic electrical temperature controller.

Berkeley & Young, Ltd., Tyseley, Birmingham.—Lists of electric fans, fires, cookers and irons.

Asea Electric, Ltd., 5, Chancery Lane, London, W.C.2.—A leaflet announcing price reductions in "Century" motors.

Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.4.—A well-illustrated art booklet dealing with air conditioning.

Drake & Gorham Wholesale, Ltd., 77, Long Acre, London, W.C.2.—A catalogue of electric vacuum cleaners.

James Neill & Co. (Sheffield), Ltd., Composite Steel Works, Napier Street, Sheffield, 11.—A leaflet dealing with a pad handle for hacksaw blades.

Benjamin Electric, Ltd., Brantwood Works, Tariff Road, Tottenham, London, N.17.—A comprehensive catalogue of equipment for electric-discharge lighting.

Bankruptcy Proceedings

W. S. Hart, 34, Arthur Street, Portsmouth, and lately 51, Park Avenue, Purbrook, Hants, electrician.—The public examination of this debtor was held on April 6th at the Court House, St. Thomas's Street, Portsmouth. The statement of affairs showed ranking liabilities of £214 and assets of £46, leaving a deficiency of £168. Debtor stated that judgments having been obtained against him by three creditors, he ceased trading in June last. His stock realised £15, which sum was paid to the creditors. He attributed his failure to loss on contracts through underestimating and competition. The examination was formally adjourned for closing.

Mrs. R. A. Robinson (trading as The Highbury Engineering Works), electrical engineer, 287, Upper Street, Islington, N.—This debtor attended at the London Bankruptcy Court last week for public examination upon accounts showing total liabilities of £805 (ranking £528) and net assets of £184. Debtor said that the failure was due to severe competition and consequent bad trade. The examination was concluded.

L. Hardaker, lately trading as radio and electrical engineer, 32, Broadgate Walk, Horsforth, Leeds.—First meeting to-day (Friday) at 24, Bond Street, Leeds. Public examination May 5th at the County Court House, Albion Place, Leeds.

A. W. Cowgill, radio and electrical engineer, 26, Water Street, and 49B, Vale Road, Rhyl. Receiving order made April 2nd on debtor's own petition. First meeting April 22nd at St. Peter's Churchyard, The Cross, Chester. Public examination, May 29th at the Court House, Bangor.

J. W. Hackett, radio and electrical engineer, 11, Paxton Terrace, Barrow-in-Furness.—First meeting April 21st at 16, Cornwallis Street, Barrow-in-Furness. Public examination, May 15th at the Magistrates' Court, Barrow-in-Furness.

G. M. Wilshaw (Wilshaw & Sharpe), electrical dealers, 18, Arkwright Street, Burnley (separate application of G. M. Wilshaw).—Application for discharge to be heard on May 14th at the County Court House, Burnley.

E. V. Russell (Skegness Electric Service), 2, Tennyson Buildings, Drummond Road, Skegness.—Discharge suspended for two months until May 12th.

G. H. Mathew (St. John's Radio), 448, Woodbridge Road, Ipswich.—Trustee, Mr. H. S. Gotelee, 9, Arcade Street, Ipswich, Official Receiver, released March 2nd.

J. S. Plumbe, electrical contractor, Liverpool Road South, Maghull.—Public examination May 12th at the Court House, Government Buildings, Victoria Street, Liverpool.

H. H. Baron, electrician, 84, Duckworth Street, Darwen.—Trustee, Mr. H. S. Haworth, 7, Lord Street West, Blackburn, Official Receiver, released March 24th.

H. J. Couzens, electrical contractor, 4a, Raven Road, Nether Edge, Sheffield.—First and final dividend of 3s. 0¾d. in the £, payable April 17th at 189, Norfolk Street, Sheffield.

Company Liquidations

British Crystal Lamp Co., Ltd., Northumberland Avenue, London, W.C.2.—Under a winding-up order made on February 24th on a creditor's petition the statutory meetings of creditors and of shareholders were held on April 8th at the Board of Trade Offices, 33, Carey Street, W.C.2. A statement of affairs was submitted showing the position at January 6th last when a receiver was appointed on behalf of a debenture holder. According to this the gross liabilities are £23,030, of which £16,399 is expected to rank and the assets are estimated at £6,631. All the assets, according to the statement, are required to pay the debenture and preferential claims and a total deficiency of £16,599 is disclosed regarding shareholders. It appeared that the company was incorporated in June, 1933, with a nominal capital of £100, afterwards increased to £200, the whole of which had been issued for cash. Its name was originally British Crystalite Co., Ltd., the company being formed to carry on business as dealers in electric lamps. In May, 1934, its present title was adopted. Its business apparently consisted solely of the sale of the "Fenbo" lamp to authorised distributors in about forty districts. By June, 1934, the amount due by the company for lamps supplied was about £12,000, and the manufacturers requested that this balance should be considerably reduced, but the company then had no funds available and £4,000 was obtained from a trading company and paid to the manufacturers. In consideration of the advance the directors issued to the trading company five debentures of £1,000 each, which constituted a floating charge on the company's assets. In July, 1934, a second debenture for £5,000 was issued to the lamp manufacturers and was also a floating charge, but a balance sheet showed that it was issued as collateral security in respect of the amount owing to them. No interest was paid on the first debentures, and, owing to the threat of a judgment creditor to levy execution the trading company on January 6th last appointed a receiver who, however, ceased to act on the Official Receiver directing his attention to the fact that the directors' borrowing powers were limited to the extent of the company's share capital and that the debentures were apparently invalid over and above the sum of £100, which was the amount of such capital when they were issued. From incorporation until March 31st, 1934, there was a gross profit on the trading of £5,983 on sales amounting to £26,439, but a net loss of £1,338, and for the year ended March 31st, 1935, the gross profit was £4,275 on sales totalling £14,488, the net loss being £4,333. The company's failure was attributed to a large number of bad debts. A resolution was passed for the appointment of Mr. R. A. Harting, 2, Coleman Street, E.C., as liquidator.

Newton & Wright, Ltd.—Winding up voluntarily. Liquidator, Mr. R. F. W. Fincham, 3, Warwick Court, Gray's Inn, W.C. This notice is purely formal and all creditors have been, or will be, paid in full.

B. & E. Battery Co., Ltd.—Winding up voluntarily. Liquidator, Mr. A. J. Gray, 10, Neville Street, Newcastle-upon-Tyne.

Electric-Sprayers, Ltd.—Winding up voluntarily. Liquidator Mr. L. R. Treen, 34 and 36, Gresham Street, E.C.

Private Arrangements

A. Whyborn, 22 and 28, Kenton Park Parade, and Field End Parade, Eastcote, electrician, &c.—The creditors interested herein met recently at Kenton, when the statement of affairs showed ranking liabilities of £1,928, of which £1,614 was due to the trade and £314 to cash creditors. After allowing £176 for preferential claims the net assets were £1,944, leaving a surplus of £16. The business had been declining and the debtor, after taking the advice of his accountant, satisfied himself that he could not continue and, therefore, left the matter in the hands of the creditors. It was decided that the matter should be dealt with under a deed of assignment to Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, London, E.C., and Mr. C. Latham, 185-188, High Holborn, London, W.C., with a committee. It was also agreed that the deed should not be registered until the expiration of seven days in order to give the debtor an opportunity of submitting a cash or guaranteed offer.

J. Donaldson-Palmer, trading as Wallis's, 100, Victoria Road, Aldershot, wireless dealer.—The creditors herein met recently at the offices of Messrs. C. Latham & Co., 185-188, High Holborn, London, W.C. The statement of affairs showed ranking liabilities of £1,380. The net assets were £227, with a deficiency of £1,154. Mr. C. Latham said that he thought there was very little prospect of any offer being forthcoming for the business as a going concern, and unless a satisfactory offer was received within a week or two there would be no alternative but to close down the business and realise the assets. It was decided to confirm the deed of assignment already executed to Mr. Latham.

Electricity Supply

Lighting, Domestic, Power

Canada.—IMPORTANT PLANT CONSTRUCTION PROJECTS.—A generating station is to be built by the Great Lakes Power Company on the Montreal River, ninety miles north of Sault Ste. Marie, in Northern Ontario, to serve the Michipicoten mining field and industries in Sault Ste. Marie. The cost is estimated at $1,000,000. A similar sum is to be spent by the British Columbia Power Company during the next two years on plant extensions and improvements, largely in the city of Vancouver.

OUTPUT DURING 1935.—The output of Canadian central electricity stations during 1935 was 23,404,408,000 kWh, representing an increase of more than ten per cent. over that of the previous year. Exported energy amounted to 1,364,589,000 kWh, an increase of 115,791,000 kWh.

Chelmsford.—STREET LIGHTING DEMONSTRATION.—Twenty electric discharge lamps in special lanterns have been erected by the County of London Electric Supply Co., Ltd., in New London Road for demonstration purposes. The gas lighting was turned off for the display, which was inspected by the Lighting Committee.

"Osram" architectural lighting in a restaurant at Selangor, Federated Malay States

Chesterfield.—BULK SUPPLY.—The Corporation has arranged with the Derbyshire and Notts Electric Power Co. for a partial bulk supply as from April 1st last.

Clacton-on-Sea.—REDUCTIONS.—The Urban District Council has made the following reductions in its tariffs:—Lighting, ordinary meters, first 750 kWh per quarter, from 5½d. to 5d. per kWh; prepayment meters, from 6½d. to 6d.; domestic tariff, present running charge of ¾d. per kWh reduced to ½d. from March to September; power, present charges of 2d. per kWh for the first 1,500 kWh per quarter, 1¾d. for the next 1,000, and 1½d. beyond, altered to 2d. per kWh for the first 1,000 kWh per quarter, and 1½d. beyond.

Colchester.—SUPPLY TO GREAT BROMLEY.—The City Council has approved terms for a supply of electricity to a wireless station to be constructed by the Air Ministry at Great Bromley and other premises in the immediate vicinity.

Deal.—LOWER CHARGES.—The South-East Kent Power Co. has reduced its standing quarterly charge per 100 W lamp from 7s. 6d. to 6s. 3d., and the "unit" charge from 1d. to ¾d.

Dorking and Horley.—OVERHEAD LINES.—The Rural District Council has decided to offer no objection to the erection of overhead lines at Lowfield Heath by the Sussex Electricity Supply Co., Ltd.

Dover.—POSSIBLE SUPPLY FOR GUSTON.—The Town Council is to inquire into the possibility of giving a supply of electricity to Guston.

Dumbarton.—ACQUISITION OF UNDERTAKING UNDER DISCUSSION.—An Electricity Committee has been appointed to consider the advisability of taking over the supply of electricity within the burgh when the lease of the present suppliers expires.

Dumfriesshire.—REVISED CHARGES.—The County Council has amended its tariffs as from December 31st last as follows:—Small consumptions: First 300 kWh per quarter, 2½d. per kWh; next 300 at 2¼d.; beyond at 2d. Consumptions exceeding 4,000 kWh per annum: First 1,000 kWh per quarter at 2d.; next 6,000 at 1½d.; next 18,000 at 1d.; beyond, at ¾d.

Finland.—WATER-POWER UTILISATION.—During the recent Electrical Week at Helsinki it was stated that there are at present 300 water-power plants in Finland, but nearly 75 per cent. of the total output is produced by twelve large plants. In the past year, which was a particularly good one, altogether 1,640 million kWh was produced by water-power, and when the large new hydro-electric station at Rouhiala is completed the total output will be increased by 500 million kWh. Even this large production is but about a fourth of what it should be possible to generate from the many waterfalls in the country.

Folkestone.—MUNICIPAL ESTATE TO BE ELECTRIFIED.—On a recommendation of the Health Committee, all the 453 houses on the municipal estate at Canterbury Road are to be provided with electrical installations, the total cost being estimated at £4,027. The tenants will be charged an extra 2d. to 4d. rent.

Formby.—LOANS.—The Urban District Council has applied for loans of £6,307 for mains and £693 for sub-stations and equipment.

High Wycombe. — LOWER CHARGES. — The Wycombe (Borough) Electric Light & Power Co., Ltd., has amended its charges as from January 1st. For weekly payment consumers the fixed charge is reduced by 2d. per week for the eight winter months, and on the domestic two-part tariff all consumption in excess of that included in the fixed quarterly charge is at 1d. instead of 1¼d. per kWh. There is a special rebate of 7½ per cent. off the accounts for the quarter ending March 31st.

India.—ELECTRICAL DEVELOPMENT IN BARODA.—Electricity is making good headway in the State of Baroda, and during the year ended July 31st, 1935, for which returns are now available, the total amount of electricity generated by the State plant was 2,534,000 kWh, as against 2,468,000 kWh in the preceding year. The sale of energy to consumers amounted to 2,057,000 kWh, as against 1,988,000 kWh in 1933-34. The preparation of a project to remodel the Baroda City supply system and to enlarge the power house at Baroda has been entrusted to a firm of consulting engineers. Besides the State electricity works at Baroda and Port Okha, there were eight plants in operation. The total load connected at July 31st last was 5,189 kW, as compared with 4,847 kW a year before, and 3,086,206 kWh was sold, as against 2,960,414 kWh in the preceding year. In order to facilitate efficient irrigation mains from the Baroda City system were extended to the area around Akot. A scheme of irrigation in the Vijapur sub-division is being considered by the Government.

ELECTRICITY CHARGES.—The Electricity Charges Inquiry Committee, which has been taking evidence and deliberating on the question of rates, is stated to have submitted its report to the Government of Bengal. The Committee sat for about four months and took a large amount of public evidence, including that of the Calcutta Corporation. The Committee was appointed, as a result of a non-official resolution in the Bengal Legislative Council, to inquire into charges for electrical energy supplied to consumers in the city and suburbs of Calcutta.—*Indian Engineering.*

Kirkcaldy.—CHANGE-OVER RECOMMENDED.—The Electricity Committee recommends the adoption of proposals by Messrs. Kennedy & Donkin for the conversion of the central area of the town to a.c., and also the development of the a.c. network in the surrounding districts. The cost is estimated at £60,150. The committee discussed the Fife Electric Power Co.'s rights to supply electricity in Dysart, a suburb of the town, and the advisability of the town's acquiring them.

Lichfield.—PROPOSED SUPPLY TO CHORLEY.—The Electricity Committee is to ask the Lichfield Rural District Council if it will meet the whole or some part of the probable loss if a supply is provided to Chorley.

Llanfairfechan.—OVERHEAD LINES.—The Urban District Council has consented to the North Wales Power Co. erecting an overhead h.v. line from Dolgarrog to Bangor so as to provide an alternative supply from Bangor should there be an interruption in that from Conway.

London.—LEWISHAM.—The Borough Council is to provide an electric fire point in each house on the Grove Park estate at an estimated cost of £630.

Mansfield.—CHANGE-OVER.—Consent is being sought by the Electricity Committee to a change-over of the supply in certain districts to a.c.

Middlesbrough.—MAINS EXTENSIONS.—Application is to be made by the Town Council for sanction to borrow £16,280 for mains extensions.

Newark.—CHEAPER ELECTRICITY.—A revised scale of charges for electricity has been approved by the Town Council as follows:—Lighting flat rate, 4¼d. per kWh up to 1,000 kWh per quarter; prepayment lighting, 5d. per kWh; heating, 1d. per kWh.

Northern Ireland.—GENERATION OF ELECTRICITY.—The official return compiled by the Ministry of Commerce shows that 58,142,781 kWh of electricity was generated by authorised undertakings in Northern Ireland during the quarter ended March 31st last as compared with 45,807,756 kWh generated in the corresponding quarter in 1935, representing an increase of 12,335,025 kWh, or 26.9 per cent.

Portland.—ELECTRICITY SUPERSEDES GAS.—A system of electric street lighting has displaced gas lighting in the Grove district, the switching-on ceremony being performed recently in the presence of Mr. F. O. Harber, electrical engineer to the Urban District Council, and others.

Portugal.—NEW PLANT AT LISBON.—In the report for 1935 of the Compagnies Réunies Gaz et Electricité de Lisbonne it is

mentioned that at the power station two old 8,000-kW turbo-generators are being replaced by modern sets of 17,000 kW capacity. New contracts for the supply of h.v. power have been entered into with the municipal authorities of Arruda and Obral.

Rugby.—MAXIMUM DEMAND TARIFF FOR H.V. SUPPLIES.—The Town Council has adopted the following tariff for h.v. supplies:—Maximum demand charge, £4 10s. per kVA (or £5 10s. per kW) per annum, with a "unit" charge of 0.25d.

Russia.—ELECTRICITY OUTPUT.—According to the *Monthly Review* of the U.S.S.R. Trade Delegation in Great Britain, Russia now takes third place in the world's output of electric power, being exceeded only by the United States and Germany.

Sandown-Shanklin (I.O.W.).—LIGHTING CONTRACT.—Having considered quotations for street lighting by gas and electricity, the District Council has decided to place a ten-year contract with the Isle of Wight Electric Light & Power Co., Ltd., whose tender of £1,500 per annum compared with £1,872 by the joint gas companies.

Scarborough.—INDUSTRIAL COOKING.—The Electricity Committee has decided that the charge for electricity for industrial cooking shall be ½d. per kWh, subject to the installed load being not less than 60 kW, the load factor to be approved from time to time by the electrical engineer. In addition the hire charge for large cookers has been reduced from 10s. 6d. to 8s. 6d. per quarter.

NEW SWITCHGEAR.—It has been decided to replace switchgear at the Falconers Road sub-station at a cost of £1,200.

South Africa.—KLIP RIVER STATION.—The first of the six turbo-alternators with which the large Klip River power station, near Vereeniging, is to be equipped, was put into commission by Mrs. H. J. van der Bijl, the wife of the chairman of the Electricity Supply Commission. The station has been built for the Commission, and will be operated by the Victoria Falls and Transvaal Power Co., Ltd. After the opening ceremony there was a reception, at which Mr. van der Bijl said that at present the Commission and the Victoria Falls Company sold 2,000,000,000 kWh a year. When the Klip station was in full operation he expected that the total would be increased to 3,000,000,000 kWh. It is anticipated that the other five turbo-alternators will be working soon, and when completed the Klip station will be the largest in Africa.

Southend-on-Sea.—INQUIRY.—A Ministry of Transport inquiry was held recently by Mr. T. J. D. Atkinson into an application by Mr. J. T. Fowler for the removal by the Central Electricity Board of pylons on land at Eastwood. It was claimed that the pylons interfered with building development. In June, 1931, the Minister consented to the erection of the pylons, and Mr. Fowler received £1,236 compensation, although he claimed £5,520. Mr. Fowler offered to give facilities free of charge for cables to be laid underground and to pay the estimated cost of the work, namely, £5,400. There was also an application by the Central Electricity Board for the renewal of a wayleave across the property of the Gaynes Park Estate, Ltd., at Eastwood. This company has purchased land on which are two towers, and the wayleave granted has expired. In this case also it was contended that if the lines remained the estate could not be developed as laid out. For the Board it was stated that the layout had been considered, and that with a slight alteration it could be carried through without the disturbance of the towers. To run the cables underground across the estate would cost £3,900.

Southport.—RATE CONTRIBUTION.—The Corporation Finance Committee is asking the Electricity Committee to make a contribution of £3,250 to the relief of rates.

Spalding.—REVISED TARIFFS.—The Urban District Council has revised its tariffs as follows:—Lighting flat rate, 7d. per kWh in the urban area and 8d. outside. Power, under 1,000 kWh per quarter, 2½d. per kWh; beyond at 1½d. Heating and domestic purposes other than lighting, 1d. per kWh. Thermostatic load, ½d. per kWh; internal floodlighting, 5d. per kWh. Vehicle charging, 8 p.m. to 8 a.m., ½d. per kWh. Domestic rate: A fixed charge of 12 per cent. of the rateable value per annum in the urban area, and 20 per cent. in the rural area, with a "unit" charge under 300 kWh of 1.8d., over 300, 0.9d., and beyond, 0.75d. Business premises, 35s. per half kW of maximum demand per quarter, plus 1.8d. per kWh. Late shop window lighting after 7 p.m. and advertising signs, 3d. per kWh. There is a discount of 5 per cent. for prompt payment of accounts.

Stockton-on-Tees.—MAINS AND SUB-STATIONS.—The Town Council proposes to spend £21,200 on electricity mains and £6,300 on equipment in connection with the erection of new sub-stations, in Eaglecliffe Road, Junction Road, Hartburn, High Street, Durham Road, &c.

Swansea.—REFRIGERATOR HIRE SCHEME.—A scheme to hire out domestic refrigerators, on which £5,000 would have to be expended over a period of three years, has been referred to a sub-committee for consideration.

Sweden.—NEW HYDRO-ELECTRIC STATIONS.—It was announced last week that Messrs. Uddeholms Aktiebolag have decided to build a new water-power station of 20,000 h.p. at the Skymnäsforsen Falls, near Munkforsen, and work on the plant will be started this autumn. A large new hydro-electric station at Krangëde is nearing completion. It has cost over 30 million Kroner (approximately £1,500,000), and will be inaugurated on July 1st by H.R.H. the Crown Prince of Sweden. The station will supply about a seventh of Stockholm's total requirements of electric power.

Torquay.—DISTRIBUTION WORK.—The Electricity Committee is to improve the distribution system between the town and Newton Abbot at a cost of £2,125, while a new sub-station is being provided to strengthen the system at a cost of £5,100.

CONCESSION.—The present practice of the Electricity Department of providing the first 30 ft. of cable for new services free of cost is to be extended to 60 ft.

NEW SUPPLY.—A supply is to be given to Stoke Gabriel at a cost of £3,720.

West Hartlepool.—SALE OF POWER STATION.—Correspondence has passed between the Town Council and the South Durham Steel & Iron Co., Ltd., regarding the sale of the Seaton Carew generating station to the company. One of the terms laid down by the Council is that the company shall undertake to restart the Seaton Carew blast furnaces within a given period, failing which it is to pay a certain sum to the Council. The company has replied that the station will only be used in connection with the West Hartlepool works or any developments which may take place there. Regarding the Seaton Carew blast furnaces, it is not in a position to state its future policy. Negotiations are proceeding. The proposed purchase price is £1,500.

West Midlands.—EXTENSION OF IRONBRIDGE POWER STATION.—The West Midlands Joint Electricity Authority is to extend the Ironbridge power station at a cost of £750,000. A new 50,000 kW generating set is proposed. At present the capacity of the station is 100,000 kW.

Whitehaven.—REVISED CHARGES.—The Town Council has reduced the "unit" charge for the specal domestic rate from ¾d. to ½d. per kWh, and the maximum demand "unit" charge from 2d. to 1½d.

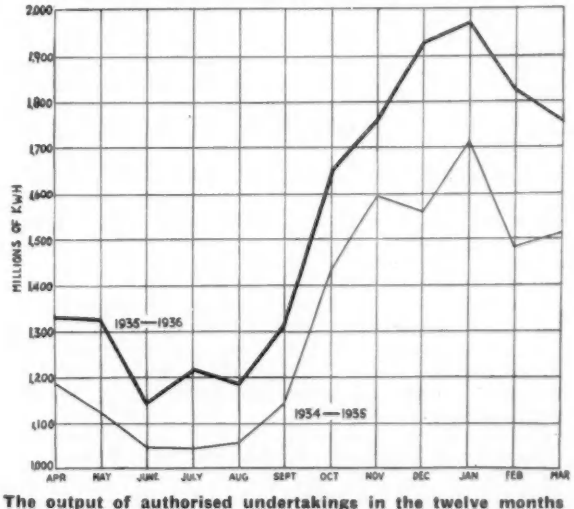
Winchester.—RURAL SUPPLIES.—The Mid-Southern Utility Co. has informed the City Council that it is prepared to undertake the supply of electricity in part of the parishes of Headbourne Worthy and King's Worthy, which are in the Corporation's area of supply.

Worcester.—STREET LIGHTING.—The City Council has adopted a modified scheme for centrally suspended road lighting in the city. Altogether 157 lamps are to be installed at a cost of £4,986.

Worksop.—INDUSTRIAL DEVELOPMENT SCHEME.—The following official statement was issued on April 8th regarding the scheme promoted by the Worksop Development Co. "The Council has received a report from its Industrial Co-ordination Committee on the result of the inquiry held by the Electricity Commissioners into the Worksop industrial development scheme. The committee reported to the Council in Committee that the

Generation of Electricity in March

THE returns rendered to the Electricity Commissioners show that 1,753 million kWh of electricity was generated by authorised undertakings in Great Britain during March, as compared with the revised figure of 1,509 million kWh in the corresponding month of 1935, representing an increase of 244 million kWh, or 16.2 per cent. The number of working days in the month (*i.e.*, excluding Sundays) was 26, the same as last year.



The output of authorised undertakings in the twelve months to the end of March last, with comparative curve for 1934-35

During the first three months of 1936 up to the end of March the total amount of electricity generated by authorised undertakings was 5,547 million kWh, as compared with the revised figure of 4,700 million kWh for the corresponding period of 1935, representing an increase of 847 million kWh, or 18 per cent.

Commissioners could not approve the scheme as presented at the inquiry. After due consideration it was decided that the Co-ordination Committee should continue its deliberations with the Town and Factories Development Co., Ltd., with a view to bringing about industrial development at Worksop." At the recent inquiry conducted by Sir John Brooke and Mr. J. M. Kennedy it was stated that this was a test case, and, if granted, similar schemes were to be adopted in South Wales, the North-East Coast and other distressed areas. The proposals involved a subsidiary of the company taking over the local electricity undertaking and erecting a power station from which steam as well as electricity would be available at cheap rates to factories. The scheme would take two years to complete and the construction work would cost £250,000. Two firms had promised to start factories at Worksop if the plan materialised and others contemplated doing so. The proposals were supported by the Borough Council and opposed by the Central Electricity Board and the Derby and Notts Electric Power Co.

Worthing.—Loan.—The Electricity Committee is seeking sanction to borrow £25,000 for mains and services.

Traction

Denmark.—Another Suburban System to be Electrified.—The Director-General of the Danish State Railways recently announced that the Ministry of Public Works had given permission for a start to be made on the electrification of the third principal suburban railway in Copenhagen. Tenders for this contract, representing a value of 5.4 million kroner (£240,000), are now invited. As British concerns have been favoured in the awarding of similar contracts regarding the construction of the two previously electrified lines, this new work should offer another opening for our manufacturers. The new line will be carried from Valby *via* Vanlose to Ballerup, and it is anticipated that the electrification will be completed in 1939.

South Africa.—Rand Railway Electrification Extension.—It has now been decided that the extension of the Rand railway electrification scheme to include Pretoria will be carried out simultaneously with the later stages of the work on the Reef lines, and £80,000 will appear in the 1936-37 estimates for this purpose. It is thus probable that electric trains will be running between Johannesburg and Pretoria, as well as all over the Reef, early next year. Some branch extensions of the Reef system have also just been announced; these will involve a considerable outlay on additional electric passenger coaches.

Sweden.—Proposed Electric Line to Boden.—*Reuter's Trade Service* learns from Stockholm that with the electrification of the northern State railway line to Aange, 484 km. from Stockholm, the scheme in respect of this line is for the time being completed, no allowances for further electrification having yet been granted. Private motions, however, have been presented to this session of the Riksdag proposing that electrification work on the line shall be continued. The Railway Board, in giving its advice on the matter, points out that an electrification of the remaining part of the line, *i.e.*, the 660 km. to Boden, would be of great importance, not only for the transport of passengers and goods, but also for the distribution of electric power in these forest-clad regions with their thin population but great economic importance. The Board, however, emphasises that such a scheme would not be remunerative. The cost is estimated at Kr.50,000,000.

United States.—Diesel-electric Bus Tests.—Tests described as highly satisfactory have been completed by a transport subsidiary of the Public Service Corporation of New Jersey involving the application of Diesel motor-power combined with electric drive in buses. The development, learns *Reuter's Trade Service* from New York, may prove an important one in local transport facilities. It is asserted that the experimental bus is the first in the world to use the Diesel-electric principle of propulsion similar to that now used in high-speed trains. It has a six-cylinder Diesel engine of 125 h.p., installed in the rear. Electric drive is a feature of bus operations of Public Service Co-ordinated Transport, which recently introduced on several of its lines " all-service " buses using energy from overhead wires or operating under their own petrol-electric engine power. The results of this innovation were gratifying and suggested further expansion of that type of service.

Communications

Belgium.—Internal Radio-telephone Communication.—In the annual report for last year of the Union des Centrales Electriques Liége-Namur-Luxembourg it is mentioned that a system of radio-telephone communication, the first of its kind in Belgium, has been established between the control offices of the Liége and Luxembourg distribution systems.

Canada.—Telephone Progress.—Canada is second among the countries of the world in the number of telephones in proportion to population, but in the number of recorded conversations per capita it is first. At the end of 1934, according to a report just issued by the Dominion Bureau of Statistics, there were 1,193,729 telephones in Canada, as compared with 1,192,330 in 1933. Decreases had been reported in 1931, 1932 and 1933. The number of residence telephones at the end of 1934 was again less than a year before, but increases in business, rural and public box telephones more than offset the decline. With an average of 11.01 telephones per 100 of the population, Canada was second only to the United States, which had 13.29, New Zealand, Denmark, and Sweden following with densities of 10.01, 9.99, and 9.51 per 100 inhabitants respectively.

The total investment in telephone systems in Canada in 1934 is placed at £66,237,400, of which stock companies accounted for £49,670,200, co-operative systems £3,618,800, municipal systems £1,217,200, and provincial government systems £11,730,800. The Dominion Government also operates a number of telephone lines, mostly rural, for which no investment figure is given. Of the total investment the Bell Telephone Co., which serves 230,849 telephones in Quebec and 443,590 in Ontario, besides providing long-distance service to a large number of connecting systems, accounts for £38,268,000. The three provincial systems in Manitoba, Saskatchewan and Alberta accounted for 17.7 per cent. of the investment and 10.7 per cent. of the telephones. The number of telephones on automatic switchboards increased from 488,826 in 1933 to 507,971 in 1934, and was in the latter year 43 per cent. of the total.

Great Britain.—Telephone Service to Morocco.—A telephone service between any place in England and Wales and Melilla, Spanish Morocco, is now available between 9 a.m. and 1 p.m. and 4 p.m. and 8 p.m.

French Railway Electrification Progress in 1935

GREAT strides were made with the electrification of the Orléans Railway Company's lines during 1935 states *Reuter's Trade Service* from Paris. In February last year three 90,000-V lines were put into service, two from Eguzon to Limoges and one from Limoges to Brive-la-Gaillarde and Marèges. Electric traction was introduced between Vierzon and Brive-le-Gaillarde last spring, thus adding another 300 km. (187 miles) of electrified line to the system. The Marèges dam was started under the most favourable conditions, and the power station began operations in October. Between Vierzon and Brive there is still some work to be done, such as equipment of the permanent way and completion of arrangements at the stations.

A new scheme of the greatest importance in railway connections between Paris and the South-West is about to be put in hand. The Orléans Railway Co. has obtained authority to electrify the Tours-Bordeaux line as part of the Government's programme for providing work for the unemployed; plans are complete and tenders are being invited.

When work on the new section is finished there will be electric traction all the way from Paris to Irun, on the Spanish frontier. As a result of the conversions already carried out electrically-hauled traffic amounted to 14,815,649 train-kilometres in 1935, as compared with 11,216,293 in 1934, and 7,775,101,900 kilometre-tons gross of goods was carried against 6,065,701,300 in 1934. These two totals are respectively 26.95 and 36.26 per cent. of the corresponding figures for the whole of the Orléans system, excluding the motor railcar traffic.

Consumption of electric power for the whole of the electrified zone rose from 160 to 216 million kWh. The Eguzon station produced 119 million kWh against 74 million kWh in 1934; the Coindre station 119 (84) million kWh; and the Marèges plant, which only started work in October last year, 31 million kWh.

On the Midi system, electric traction has been introduced between Montauban and Sète. Traffic hauled by electricity on this system reached 15,373,380 train-kilometres in 1935, against 14,531,194 in 1934, and goods 4,481,895,200 against 3,946,833,100 gross kilometre-tons, these figures being respectively 50.44 and 49.06 per cent. of the corresponding figures for the whole of the Midi system, excluding railcars. Consumption of electric power totalled 182,000,000 kWh. The Midi company is also undertaking a number of improvements. The automatic block system with luminous signalling has been installed between Bretigny and Les Aubrais, and the same system is to be introduced between Bordeaux and Langon and Bordeaux and Arcachon.

The Paris-Orléans Company's fleet of railcars has been considerably augmented. The length of track over which railcars now run on the Paris-Orléans-Midi system has risen by 752 to 2,414 km. while the figure for daily train-km. has increased by over 170 per cent., although the number of cars is only up by 92 per cent. It is expected that new railcar centres will be started at Aurillac and Narbonne.

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Bacup.—April 22nd. Electricity Department. E.h.p. and l.p. p.i. cables during the twelve months ending April 30th, 1937. (April 10th.)

Beckenham.—April 27th. Borough Council. House service cut-outs from May 1st, 1936, to March 31st, 1937. (April 10th.)

Boxhill.—May 5th. Electricity Department. E.h.p. and l.p. switchgear. (April 10th.)

Birmingham.—May 7th. Committee of Visitors of the Mental Hospital. X-ray apparatus at the Hollymoor Mental Hospital, Northfield. (See this issue.)

Blackpool.—April 21st. Electricity Department. Meters for one year. (March 27th.)
April 25th. Corporation. One 1,000-kW steel tank rectifier and equipment. (April 3rd.)

Carlisle.—April 24th. Electricity Department. Cable and lamps. (April 10th.)

Coatbridge.—May 18th. Town Council. Various works, including electrical, heating and ventilating installations and filtration plant at the new public baths, municipal swimming pond and public health offices. Town clerk, Municipal Buildings (deposit £2 2s.).

Dagenham.—May 2nd. U.D.C. Electrical installation and hot water heating at the new Becontree Branch library. (See this issue.)

Darlington.—April 20th. Corporation. Mercury-arc rectifiers. (April 3rd.)

Dumfries.—April 21st. Town Council. Electrical work at reconstruction of Girls' Home. Borough surveyor.

Dundee.—April 20th. Housing Department. Electric lighting installations at the Beechwood estate. City quantity surveyor, 21, City Square.

East Africa.—Lourenco Marques.—May 21st. Mozambique Ports and Railways Administration. One 25-kVA, 3-phase, 50-cycle alternator, exciter, control and distribution switchboard and accessories. (T.Y. 40023.)*

Eccles.—April 27th. Electricity Supply Committee. Two 500-kVA 3-phase oil-cooled transformers and a metal-clad ring main e.h.p. switchgear control unit. Borough electrical engineer, Electricity Offices, 1, King Street.

Eyemouth (Berwickshire).—April 25th. Town Council. Electric lighting installations in thirty-two houses. Town Clerk (deposit £1 1s.).

Farnborough.—April 24th. U.D.C. Electrically driven air compressor for the sewage works. (April 10th.)

Fife.—May 2nd. District Asylum Works Department. Electrical fittings for one year. Resident clerk of works, Fife District Asylum, Cupar.

Finchley.—May 25th. Electricity Department. One rotary balancer set complete with automatic starting panel and glass bulb mercury arc rectifiers. (See this issue.)

Gainsborough.—April 18th. Electricity Department. Switchboard and transformer. (April 3rd.)

Glasgow.—April 21st. Transport Department. Materials for one year, including electrodes, &c. General manager, 46, Bath Street.
April 21st. Public Assistance Department. Stores for one year, including electrical fittings. Contract Department, 266, George Street.

Hastings.—April 30th. Electricity Department. Switchboard and two transformers. (April 3rd.) Electric cookers during the period from May 16th, 1936, to March 31st, 1937, and boiler fuel for use on mechanical stokers during the year ending June 30th, 1937. (See this issue.)

Heston and Isleworth.—April 20th. Electricity Department. Transformer and switchgear. (April 3rd.)

Hull.—April 23rd. Education Sub-Committee. Electrical installations in the first portion of the infants' department at Cavendish Road school. D. Harvey, city architect, Guildhall (deposit £1 1s.).

Leeds.—April 20th. Housing Committee. Electrical installations on housing estates. (April 3rd.)
April 21st. City Council. Electrical installation in temporary buildings at the Wyther Park Council school. F. Broadbent, architect, Room 120, Civic Hall (deposit £1 1s.).

London.—Islington.—June 10th. Borough Council. Street lamp columns, emergency battery, installation of fire-resisting apparatus in connection with new switchgear and transformers. (April 3rd.)
Stepney.—April 27th. Electricity Department. Electrical materials for one year. (April 3rd.)
London and Home Counties J.E.A.—May 11th. Transformers for one year. (See this issue.)
St. Marylebone.—April 28th. Borough Council. Cables during the twelve months ending May 31st, 1937. (See this issue.)

Middlesex.—May 13th. County Council. Electrical installation, comprising wiring for lighting, power and clock services at the Local County Offices, Brentford. (See this issue.)

Morecambe and Heysham.—April 24th. Electricity Department. E.h.p. switchgear. (April 10th.)

New Zealand.—Wellington.—June 5th. Post and Telegraph Department. Eight miles of single solid conductor rubber-insulated taped and braided cable. (T.Y. 10447.)*
May 26th. Galvanised earth rods. (T.Y. 30005.)*
June 8th. One 17-kVA power-factor correction condenser. (T.Y. 40028.)*

Northern Ireland.—Belfast.—April 20th. Electricity Department. Current limiting resistances and 33-kV switchgear and protective equipment. (April 3rd.)

Oldham.—April 20th. Housing Committee. Electric lighting in 162 houses and twelve bungalows on the Stoneleigh estate. Borough Engineer and Surveyor's Office, Town Hall (deposit £1 1s.).

Ormskirk.—April 25th. U.D.C. Electrical pumping plant at the Greetby Hill waterworks. J. Haydn Thomas, clerk to the Council (deposit £3 3s.).

Paisley.—April 23rd. Corporation. Electrical installation at new offices. Master of Works, 16, Gilmour Street.

Prestatyn.—April 18th. Electricity Department. L.p. cables, joint boxes, cutouts, &c. (April 3rd.)

Rowley Regis.—April 25th. Corporation. Electric lighting installations in the Old Hill and Blackheath Libraries. Borough surveyor, Haden Hill Park Offices, Old Hill, Staffs.

Settle.—April 27th. County Council of the West Riding of Yorkshire. Electric lighting at the Girls' High school. Education officer, County Hall, Wakefield.

South Africa.—Johannesburg.—April 25th. City Council. Two electrically driven centrifugal sewage pumps. (T.Y. 30034.)*
May 5th. Rand Water Board. One 3,000-kW steam turbine driven alternator with auxiliaries, &c., and switchgear. (T.Y. 40017.)*
Cape Town.—April 29th. Electricity Department. Two electric passenger lifts. (T.Y. 5816.)*
Pretoria.—May 15th. Union Tender and Supplies Board. Galvanised iron telegraph arms and pole fittings, &c. (T.Y. 40037.)*

Stoke-on-Trent.—May 6th. North West Midlands Joint Electricity Authority. Outdoor type static transformers with on-load tap changing equipment. (See this issue.)

Swansea.—April 20th. Electricity Department. Cables. (April 10th.)

Uruguay.—Montevideo.—May 12th. State Electricity Supply and Telephones Administration. Insulated copper conductors for outdoor use. (T.Y. 10446.)*

Warrington.—April 20th. Electricity Department. Transformers. (April 3rd.)

Weymouth and Melcombe Regis.—April 27th. Electricity Department. Cables. (See this issue.)

Wigan.—May 11th. Electricity Department. Cables for one year. (April 10th.)

Wigtown.—April 24th. County Council. Installation of electrical conduit at housing estate. County architect, Stranraer (deposit £1).

Willesden.—April 27th. Corporation. Six-body mortuary cabinet with electrical refrigerating equipment, trays and racks and four electric refrigerators. (See this issue.)

* Further particulars from the Department of Overseas Trade (Inquiry Room), 36, Old Queen Street, London, S.W.1.

Contracts Closed

Aberdeen.—County Council. Education Committee. Accepted. Electric lighting at Strichen new school.—Andrew McRobb.

Darlington.—Town Council. Accepted. H.p. switchgear.—A. Reyrolle & Co.

Douglas (I.o.M.).—Electricity Committee. Accepted. 250-kW house service set for the Pulrose power station (£1,540).—Richardsons Westgarth Brown Boveri, Ltd.

Dover.—Town Council. Accepted. Cables.—Henley's. Meters.—Met.-Vick. Transformers.—British Electric Transformer Co.

Dundee.—Town Council. Accepted. Electric lighting of the new R.C. school of St. Mary's, Lochee (£730).—J. A. Hackney.

Gloucestershire.—Education Committee. Accepted. Electric lighting at Lydney Grammar school extensions (£115).—Forest Battery Service.

King's Lynn.—Norfolk C.C. Accepted. Rewiring institution (£382).—J. E. Culey.

London.—Fulham.—Electricity Committee. Recommended. Steam pipework at power station (£14,201).—Aiton & Co. Feed water and other pipework (£6,979), and flue dust plant (£5,000). —Stewarts & Lloyds.
L.C.C.—Installation of electricity at the Elm Court Residential School.

	£
Pemberton & Sturgess (Great Britain), Ltd. (Accepted)	**479**
Holliday, Hall & Stinson, Ltd.	483
Payne Bros.	490
V. T. Montrose & Co., Ltd.	552
G.E.T. Installation Co.	587
Davis Myer & Co.	592
C. J. Ferguson & Sons, Ltd	622
E. W. Merredew	633
Houchin, Ltd.	975

Wiring and fittings for electric lighting, heating and cooking in Block 7 of Orchardson House on the Lilestone estate, St. Marylebone :—

	£
Springvale Electrical Co. (Accepted)	**968**
Holliday, Hall & Stinson, Ltd.	1,148
S. Reed & Sons	1,209
Bower Engineering Works (Electrical and General), Ltd.	1,224
T. B. Watson & Sons, Ltd.	1,235
F. Angell & Co., Ltd.	1,280
City Electrical Co.	1,367
Basinghall Electric Co., Ltd.	1,644
G. E. Wallis & Sons, Ltd.	1,934
A. E. Mayhew & Co.	2,332

Manchester.—Transport Committee. Accepted. Supplies for twelve months: Two-way connectors, porcelain insulators and solenoid coils for point controllers.—Forest City Electric Co. Motor controller fingers, contact fingers and tips for circuit-breakers.—Fairless Engg. Supplies Co. Cable.—W. T. Glover & Co.; Mersey Cable Works. Main and interpole field coils, armature coils, divisions for arc deflectors, and gear and pinion wheels.—Met-Vick. Switches.—J. Walton & Son. Wire and brass armoured cable.—Ward & Goldstone.

Portland.—Electricity Committee. Accepted. Cable.—Pirelli-General Cable Works; Hackbridge Cable Co. Meters.—Landis & Gyr; Siemens Electric Lamps & Supplies; Ferranti. Service cut-outs.—Henley's. Outdoor cut-outs.—Lucy & Co. Joint boxes.—W. H. Baker & Co. Lead sleeves.—Pirelli-General Cable Works. Compound.—Dussek Bitumen Co. Cookers.—Jackson Electric Stove Co. Cooker control units.—A. Reyrolle & Co. Kettles.—Bulpitt & Co.

Southport.—Attractions Committee. Accepted for illuminations scheme. Fifty-four Venetian lanterns and twenty floodlights (£602).—G.E.C. Four mercury arc rectifiers (£244).—Electric Construction Co. Hire of forty batteries for the season (£52).—Britannia Batteries.

Torquay.—Electricity Committee. Accepted. Cables.—Union Cable Co.; Mersey Cable Works.

Workington.—Electricity Committee. Accepted. Switchgear (£124).—English Electric Co.

Worthing.—Electricity Committee. Accepted. Cables for twelve months.—Enfield Cable Works; Derby Cables. Kiosk for Newlands Park estate (£365).—W. Lucy & Co.

Forthcoming Events

Institution of Electrical Engineers.—Thursday, April 23rd. Institution, London, W.C.2. 6 p.m. The twenty-seventh Kelvin Lecture. "The Transmutations of Matter by High-energy Particles and Radiations." Mr. J. D. Cockcroft.

North-Eastern Centre.—Monday, April 20th. Armstrong College, Newcastle-upon-Tyne. 6.15 p.m. Annual general meeting. "Cineradiography." Dr. R. J. Reynolds.

Tees-Side Sub-Centre.—Monday, April 20th. Cleveland Technical Institute, Middlesbrough. 6.45 p.m. Annual general meeting. "Change of Frequency." Mr. S. Burns.

Western Centre.—Monday, April 20th. The Guildhall, Plymouth. 7 p.m. "Atmospherics." Mr. R. A. Watson Watt.

North-Western Centre.—Tuesday, April 21st. Engineers' Club, Manchester. 7.15 p.m. "Remote Control of Power Networks." Messrs. G. A. Burns and T. R. Rayner.

Transmission Section.—Wednesday, April 22nd. Institution, London, W.C.2. 6 p.m. E.R.A. Report. "A Statistical Survey of the Performance of Automatic Protective Systems." Presented by Mr. F. C. Winfield.

Electrical Industries Benevolent Association (*South Coast Branch*).—Friday, April 17th. Grand Hotel, Brighton. 8.30 p.m. Ball.

Faraday Society.—Monday, April 20th, to Wednesday, April 22nd. The University, Leeds. General discussion on "Disperse Systems in Gases; Dust, Smoke and Fog."

Association of Supervising Electrical Engineers.—Tuesday, April 21st. E.L.M.A. Lighting Service Bureau, London, W.C.2. 7.15 p.m. "A.C. Commutator Motors and Their Applications." Mr. R. D. Given.

Electrical Association for Women.—Tuesday, April 21st. 20, Regent Street, London, S.W.1. 3 p.m. "Colour and Electricity—The Healing Forces of the Future." Mr. J. Deighton Patmore.

Institution of Chemical Engineers.—Wednesday, April 22nd. Burlington House, London, W.1. 6.30 p.m. "The Design of Vessels to Withstand High Internal Pressure." Dr. D. M. Newitt.

Birmingham Electric Club.—Friday, April 24th. Grand Hotel, Birmingham. 7 p.m. Meeting.

Society of Chemical Industry (*Chemical Engineering Group*).—Friday, April 24th. Waldorf Hotel, London, W.C.2. 6.45 p.m. Annual general meeting and dinner.

Institution of Engineers-in-Charge.—Friday, April 24th. Holborn Restaurant, London, W.C.2. Annual dinner.

Institution of Mechanical Engineers.—Friday, April 24th. Institution, London, S.W.1. Second report of the Welding Research Committee.

Our Service Department

EVERY day inquiries of all kinds are received by the Editors, the bulk of them relating to the producers of specified classes of electrical goods. We are able to reply to most of these with the aid of our extensive records, but in a few cases we have to seek the assistance of our readers. This week we have been asked for the names and addresses of manufacturers of the following:—

OHIO vacuum cleaner.

VULCAN magnetic drive for a Hulse planer.

Readers should enclose stamped addressed envelopes when making their inquiries.

Notes

Orphanage Votes Wanted

Will any of our readers who are subscribers to the Royal Infant Orphanage, Wanstead, and have votes for the May, 1936, election of candidates for admission, kindly entrust them to our care? We wish to pass them on to the Electrical Industries Benevolent Association for use on behalf of three of the five children of a widow whose case has recently been before that organisation and is one of great urgency. Please send your votes addressed to the Editors, ELECTRICAL REVIEW, Dorset House, Stamford Street, S.E.1. If you are not a subscriber possibly you know somebody who is!

Metals and Alloys for Overhead Work

Failure of metals and alloys in service in overhead lines is attributed by British Insulated Cables, Ltd., to the following causes in the majority of cases:—(1) Incorrect methods of suspension of wrought materials, resulting in fatigue; (2) the use of metals and alloys in positions for which they are unsuitable, so that corrosion due to atmospheric conditions rapidly follows; and (3) the use in contact with each other of metals having a large electro-chemical potential difference, which leads to corrosion due to galvanic action. With reference to (1) many specimens submitted as faulty to the B.I. technical departments have proved, on critical examination, to be in excellent physical condition, fracture having been caused by fatigue cracks due to vibration consequent on incorrect suspension. In other cases, where current has been collected from a contact or trolley wire, fusion due to arcing has resulted in breakdown. Examination of the material immediately adjacent to the fused portion showed the characteristics to be quite normal, the arcing being caused by "hard spots" arising from an irregularity in the suspension of the conductor. As regards (2) some of the failures encountered have been traced to the use of an unsuitable metal or alloy, surface or intercrystalline corrosion having produced a rapid failure; the substitution of another metal having the desired properties gave excellent results.

The company was recently asked to investigate certain failures of overhead fittings on an electrified railway. It was found that the metals and alloys employed were such as to bring about the corrosion referred to in (3) and that season cracking had also occurred.

Symmetrical Light Distribution

To plan lighting installations by reference to polar curves of light distribution from the fittings which it is proposed to use is a laborious point-by-point method of calculation. The light flux method is now almost universally used, but it is still necessary to know the spacing-height ratio of the fittings for the uniformity of illumination required. When B.S.S. 398 was first published in 1930 two classifications were given. First, the distribution of flux in the upper and lower hemispheres determining whether the distribution was direct, indirect, &c., and secondly, the general shape of the polar curve was indicated by the ratio of its width divided by its height—the frame ratio.

In the revision B.S.S. 398-1936, just published, there is tabulated additional information giving the relation between frame ratio and spacing-height ratio. for two values of uniformity of illumination, 70 per cent. of which is that required up to, say, 20 foot-candles, and 50 per cent. being that allowable for higher values of illumination. The original polar curve is now entirely unnecessary, it being only necessary to specify by reference to B.S.S. 398, 1936, the class of distribution direct, indirect, &c., and the spacing-height ratio for the uniformity required. Copies of this British Standard (No. 398-1936) may be obtained from the Publications Department, British Standards Institution, 28, Victoria Street, London, S.W.1, price 2s. 2d. post free.

I.E.E. Golf Competition

The golf competition organised by the Mersey and North Wales (Liverpool) Centre of the Institution of Electrical Engineers in aid of the I.E.E. Benevolent Fund is to be held at the Royal Liverpool Golf Club, Hoylake, on May 13th. In addition to the G. P. Dennis Trophy, there will be other prizes (toward which many electrical firms have made donations), as well as optional events, with dinner in the club house and presentation of the prizes in the evening. Last year's event (the ninth competition) resulted in a donation of £120 to the Benevolent Fund.

E.A.W. Activities

Sixty members of the Plymouth and District Branch of the Electrical Association for Women attended the seventh annual meeting held recently. Coun. Mrs. C. H. Daymond presided, and very satisfactory reports were given by Mrs. W. A. Gallon, hon. secretary, and Mrs. W. H. Sloman, hon. treasurer.

Appointments Vacant

Assistant superintendent for the L.C.C. Northern Outfall Works and North Woolwich pumping station.

Assistant engineer for the Nigerian Government Posts and Telegraphs Department.

Canvasser for the Cheadle and Gatley Electricity Supply Department.

(See our classified advertisements.)

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Mr. R. F. Smith, traffic superintendent of the Glasgow Corporation transport services, is recommended for appointment as deputy general manager at a salary of £1,000, rising to £1,250, per annum. He was formerly an accountant, and has been traffic superintendent since 1927. **Mr. G. W. Alexander,** accountant, is to be appointed secretary and financial superintendent at a salary of £800, rising to £1,000, per annum. He has been accountant since 1927.

The Faraday Medal (fourteenth award) will be presented to **Sir William H. Bragg,** O.M., K.B.E., at the ordinary meeting of the Institution of Electrical Engineers to be held on April 23rd. The presentation will precede the twenty-seventh Kelvin Lecture, which will be delivered by Dr. J. D. Cockcroft, on "The Transmutation of Matter by High-Energy Particles and Radiations."

Mr. I. B. Walker, A.M.I.E.E., the author of the article on "The Load Incidence of High-class Flats," on page 558, is commercial engineer to the Kensington and Knightsbridge Electric Lighting Co., Ltd. Mr. Walker received his early engineering training at Bedford School, and after the War completed his technical training at Faraday House, where he gained a silver medal and honours diploma. His practical training was obtained with Messrs. Belliss & Morcom, Messrs. Bruce Peebles, and the Birmingham Corporation Electric Supply Department. Before transferring his activities to the commercial sphere, Mr. Walker was for many years engaged in the generation and distribution departments of supply undertakings.

Mr. A. S. Johnson has been elected president of the Paisley Association of Electrical Engineers for the session 1936-37.

Mr. A. H. Bellamy, assistant to the manager and engineer of the Isle of Man Electricity Board, has been appointed manager and engineer in succession to Mr. J. P. Tucker, who, as we have already announced, has been appointed borough electrical engineer of Loughborough.

Mr. J. S. Pickles, county electrical engineer of Dumfriesshire, has been granted an increase in salary from £850 to £900 per annum as from October 26th next, with annual increments of £50 to a maximum of £1,000 per annum. The County Council has also agreed that the scale of salary of **Mr. D. Ross,** deputy county electrical engineer, shall be £500, rising by annual increments of £25 to £600 per annum, and that he shall be regarded as having completed two years' satisfactory service on that scale at December 25th last.

Mr. R. F. Mathieson has been appointed sales engineer in the Midlands area for the E.M.B. Co., Ltd. Mr. Mathieson will have his headquarters at Moor Street, Birmingham, and will be especially concerned with motor control gear and starting gear.

Mr. C. W. Pass, B.Sc. (Hons.), has been appointed technical assistant to the consumers' engineer with the Southampton Corporation Electricity Department. Mr. Pass received his practical training with the Metropolitan-Vickers Electrical Co., Ltd., at Trafford Park, Manchester, and his technical training at Manchester University. He subsequently spent two years in India as sales engineer with Messrs. Greaves Cotton, of Bombay. Before going to Southampton Mr. Pass was on the staff of the Birmingham Electric Supply Department.

Mr. C. F. Bishop has been appointed a director of Messrs. Thos. W. Ward, Ltd., Sheffield, and Messrs. J. Bussey, Arnold Carr, H. W. Secker and H. Vernon have been appointed local directors.

Mr. A. S. Ward has been appointed managing director of Messrs. Marshall Sons & Co. (Successors), Ltd., of Gainsborough, which has just undergone reconstruction. He is joint managing director of Messrs. Thos. W. Ward, Ltd., and a director of the Laycock Engineering Co., Ltd.

Mr. G. B. Seawright, managing director of Arrow Electric Switches, Ltd., left London on April 9th for the United States primarily to study new electrical developments, the American domestic appliance market, and trends in electric cooking apparatus. The company is extending its factory and Mr. Seawright's visit to America will be of assistance in planning the additional manufacturing equipment which it is proposed to install.

At a meeting of the Fulham Borough Council on April 8th the following were appointed assistant operating engineers at the new power station at a salary in each case of £517 :— Messrs. P. Briggs, A. R. A. Harris, F. C. Outram and H. E. Vickers. **Mr. Briggs** was in the Islington Borough Council's electricity undertaking from 1926 to 1929. In the latter year he joined the Fulham Council as relief charge engineer, and he has been charge engineer since 1934. **Mr. Harris,** after serving his apprenticeship with the Metropolitan-Vickers Electrical Co., Ltd., was shift charge engineer with the Oldham Corporation and technical engineer in the outside erection department and electrical tester with the Met.-Vick. Co. Since March, 1931, he has held the position of shift charge engineer at the Croydon Corporation electricity works. **Mr. Outram** served his apprenticeship with the Sheffield Corporation Electricity Department, following which he was junior engineer with the Department for one year. From 1930 to date he has held the position of charge engineer with the Hull Corporation Electricity Department, and previously, for seven years, was assistant shift engineer in the same department. He is an A.M.I.E.E. **Mr. Vickers** has held the position of charge engineer in the Hull Electricity Department from 1932 to date. He was apprenticed to the Barnsley Corporation Electricity Department, and has had experience with Worcester Corporation, and the Yorkshire Electric Power Co. He also is an A.M.I.E.E.

Mr. Juel-Hansen, director-general of the Copenhagen Tramcar & Bus Co., has recently returned to Denmark after a visit to London during which he inspected the trolley-bus services of the London Passenger Transport Board. He has persuaded the Copenhagen Corporation to grant permission for the introduction of a trolley-bus service in the Danish metropolis, and orders for five vehicles are to be placed with British firms. These will be of the single-deck three-axle design, to seat fifty passengers. It is also reported that the N.E.S.A. Co., which operates the tramcar services in the suburbs north of Copenhagen, is also to place orders for trolley-buses with British firms. In an interview, Mr. Hansen said that he was favourably impressed by the London trolley-bus services and he was a firm believer in the future progress of this type of transport.

Mr. Juel-Hansen

Mr. F. E. Spencer has been elected chairman of the Mersey and North Wales (Liverpool) Centre of the Institution of Electrical Engineers for the session 1936-37.

Mr. Francis C. Polden, M.I.E.E., M.I.Mech.E., has, by resolution of the Court of Common Council of the City Corporation, been appointed its representative on the London and Home Counties Joint Electricity Authority, in succession to the late Mr. Albion T. Snell.

Mr. H. P. Crush, a technical assistant in the Chief Engineer's Department of the London County Council, has been appointed senior assistant (technical) at a salary of £560, rising to £660, and **Mr. F. A. Hill,** A.M.I.E.E., who is also a technical assistant, has been granted the temporary rank of senior assistant (technical) at a salary of £540 per annum, rising to £660.

Mr. H. M. Gale, B.Sc., a member of the technical and research staff of Messrs. A. Reyrolle & Co., Ltd., was married on April 13th to **Miss Nancy Wright,** who has been employed in the Orders and Progress Department of the company. Miss Wright received a canteen of cutlery from the staff of her Department and Mr. Gale received a chromium electric fire from the staff of his Department.

Obituary

Mr. E. Dann-Sharpey.—The death occurred on March 30th, at the age of sixty-nine, of Mr. Edward Dann-Sharpey, who was a pioneer of electric lighting at Rye, having installed the first generating plant there. He also established the first electrical goods business in the town, and was connected with it up to the time of his death.

Mr. H. J. Butcher, senior director of Messrs. Read & Partners, Ltd., died on April 10th. He was associated for many years with Edmundsons Electricity Corporation, Ltd., and with the late Mr. H. J. Read and Mr. W. J. Bransom, the present managing director, founded the firm of Read & Partners, Ltd., in 1920.

Mr. C. H. Ormrod, whose sudden death is announced at the age of sixty-three, was engineer-in-charge of the C.E.B. station at Nursling, having held that position since the opening of the station about two and a half years ago.

Mr. H. A. Earle.—The death occurred recently at Brighton of Mr. Hardman A. Earle, M.I.E.E., who was joint managing director of the Chloride Electrical Storage Syndicate, Ltd., the predecessor of the Chloride Electrical Storage Co., Ltd. He discontinued active association with the company forty years ago.

Will.—Mr. Albion T. Snell, consulting engineer, of Albion T. Snell & Partners, left £27,444, with net personalty £27,170.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

Newman Industries, Ltd.—Public company. Registered April 3rd. Nominal capital, £90,000. Objects: To acquire all or any part of the undertaking, business, property and assets and liabilities of the business of Newman, Sons & Co., Ltd., and to carry on the business of electrical and mechanical engineers, manufacturers of machinery of all kinds, aeroplane manufacturers, toolmakers, brassfounders, motor engineers, dealers in motor vehicles, &c. The subscribers are: A. Harvey, 28, The Crescent, Ilford; E. E. Pickering, 18, Hickling Street, S.E.16; and five others. Solicitors: Grundy, Kershaw, Samson & Co., 6, Austin Friars, E.C.2.

Hallahan's, Ltd.—Private company. Registered April 7th. Capital, £2,500. Objects: To acquire the business of an electrical contractor and dealer in radio and gramophone records carried on by T. C. Luckett at 8, Kingsbury Square, Aylesbury. The directors are: G. Gibbard and D. G. Gibbard, both of Crouch Farm, Banbury; and T. C. Luckett, High Street, Banbury.

Electrical Commodities, Ltd.—Private company. Registered April 8th. Capital, £2,000. Objects: To carry on the business of importers of and dealers in electrical refrigerators, clocks, washing machines, vacuum cleaners, &c. The directors are: M. Sobell (director of Solectric, Ltd.), and Anna Sobell, both of 74, Hurstwood Road, Golders Green, N.W.11. Registered office: Duke Street House, 415/417, Oxford Street, W.1.

Wild & Steele, Ltd.—Private company. Registered April 4th. Capital, £4,000. Objects: To acquire the business of wireless and electrical dealers and engineers formerly carried on by H. G. Wild and A. H. Steele as Wild & Steele, at 1, Carfax Buildings, Headington, Oxford. The life directors are: H. G. Wild, 41, Ash Grove, Headington, Oxford, and A. H. Steele, Three Pigeons, Tiddington, Oxon. Registered office: 1, Carfax Buildings, Headington, Oxford.

Traies & Co., Ltd.—Private company. Registered April 8th. Capital, £500. Objects: To carry on the business of general, constructional, electrical, sanitary, telephonic and telegraphic engineers and contractors, &c. The directors are: A. Standish and Mrs. R. P. Standish, both of 118, St. James Road, Gorringe Park, Mitcham, Surrey, and D. M. Murdoch, 22, Woodland Way, Mitcham. Registered office: 6, Elgin Crescent, London, W.11.

Caine Pernot, Ltd.—Private company. Registered April 8th. Capital, £2,005. Objects: To carry on the business of electrical and general engineers and contractors, &c. The directors are: K. E. Caine (permanent managing director and chairman), 311, Great West Road, Hounslow, Middlesex, and four others. Secretary: J. H. Hardy. Solicitors: E. C. Kilsby & Son, 21, College Hill, E.C.4.

Nersun, Ltd.—Private company. Registered April 3rd. Capital, £1,000 in £1 shares. Objects: To carry on business in connection with heating apparatus, refrigerators, water softeners and household, domestic and general appliances of all descriptions; to carry out installation work in connection therewith, &c. The permanent directors are: G. M. Haworth and F. G. Haworth, both of 31, Amesbury Crescent, Hove; and J. I. Austin-Walton, 33, Beechers Road, Portslade. Registered office: 75/77, Church Road, Hove, 3.

A. H. Hunt, Ltd.—Private company. Registered April 3rd. Capital, £10,000. Objects: To carry on the business of manufacturers, importers and exporters of and dealers in machinery for the generation, transmission and utilisation of electricity, radio, radio parts and appliances, &c. The permanent directors are: O. Paschkes, 457, East Sidney Avenue, City of Mount Vernon, N.Y. (director of Solar Mfg. Corporation, New York); P. Hetenyi, 325, West 86th Street, Manhattan, New York (director of Solar Mfg. Corporation); and C. H. Hunt, Brightleigh, Outwood, Surrey. Solicitors: Merriman, White & Co., 3, King's Bench Walk, E.C.

Central Electrical Co. (Colchester), Ltd.—Private company. Registered April 1st. Capital, £1,500. Objects: To acquire the business of electrical contractors and engineers and radio dealers carried on by L. E. W. Johnson and D. H. Butcher at Culver Street, Colchester, as the Central Electrical Co. The permanent joint managing directors are: L. E. W. Johnson, 55, King Harold Road, Colchester; and D. H. Butcher, "Appledore," Old Heath Road, Colchester. Registered office: Culver Street, Colchester.

Vent-Axia, Ltd.—Private company. Registered April 4th. Capital, £10,000. Objects: To take a licence to work certain patents relating to air conditioning equipment and for that purpose to enter into a deed with Winsor Axia Fans, Ltd., of the first part, J. C. Akister of the second part, and this company of the third part. The first directors are: R. G. Willis, J. C. Akester, J. G. G. Noble and Jas. R. Kennedy. Solicitors: Godden, Holme & Ward, Old Jewry, E.C.2.

Livewires, Ltd.—Private company. Registered April 4th. Capital, £1,000. Objects: To carry on the business of manufacturers, importers and exporters of and dealers in wireless, telephonic and television apparatus, component parts, &c. The directors are: S. H. Davis, 18, Belmont Road, Smethwick, and two others. Registered office: 10, Cape Hill, Smethwick.

Torbay Electric, Ltd.—Private company. Registered April 4th. Capital, £1,000. Objects: To carry on the business of electrical engineers and contractors, &c. The first directors are: Mrs. C. E. Lewsey, 5, Park Crescent, Torquay; and F. N. Hope-Johnstone, "Alston," Thurlow Park, Torquay. Registered office: 29, Forward Street, Torquay.

Winfray Engineering Co., Ltd.—Private company. Registered April 4th. Capital, £800. Objects: To carry on the business of general electrical, radio, motor, marine and constructional and consulting engineers, &c. The directors are: A. Upham, 9, Davenport Road, Coventry; and E. D. Clarke, 23, Calndon Road, Coventry. Registered office: East Street Works, Coventry.

Electric Switch Warner Co., Ltd.—Private company. Registered March 26th. Capital, £3,000 in £1 shares. Objects: To adopt an agreement with J. I. Rodway, to carry on the business of electrical, automobile, hydraulic, mechanical and general engineers, manufacturers of and dealers in component parts, accessories and fittings for all kinds of motor vehicles, &c. The subscribers are: Sir F. H. Pepper, 34, Waterloo Street, Birmingham, and J. I. Rodway, "Ellesmere," Montefiore Avenue, Ramsgate. J. I. Rodway is first director and chairman. Registered office: 34, Waterloo Street, Birmingham.

W. J. Powell, Ltd.—Private company. Registered April 1st. Capital, £2,000. Objects: To acquire the business of an electrical contractor and hot and cold water, heating and general engineer carried on by W. J. G. Powell at Ashton Keynes, Wilts, as W. J. Powell. The subscribers are: W. J. G. Powell and J. W. Powell, both of Ashton Keynes, Wilts. The first directors are Walter J. G. Powell (permanent managing director and chairman) and Mrs. Mary M. Powell.

Holfords, Ltd.—Private company. Registered March 31st. Capital, £1,000. Objects: To carry on the business of manufacturers of and dealers in electrical lamps, bells, fires, stoves, cookers, &c. The first and life directors are: M. Haworth (chairman), 31, Amesbury Crescent, Hove; and H. L. Holford, Gate House, Woodland Drive, Hove. Secretary: J. C. J. Clark. Registered office: 75/77, Church Road, Hove.

W. A. Gazard & Son, Ltd.—Private company. Registered March 30th. Capital, £1,000. Objects: To carry on the business of electricians, electrical contractors, mechanical engineers, manufacturers of and dealers in electrical instruments, radio and musical instruments, &c. The life directors are: W. A. Gazard and Bertha Gazard, both of 14, Red House Road, Yardley, Birmingham. Registered office: 195B, Station Road, Stechford, Birmingham.

Broxmead Electric, Ltd.—Private company. Registered March 27th. Capital, £7,500. Objects: To carry on the business of makers, buyers and sellers of, selling agents for and dealers in every kind of appliance for domestic use, electrical and mechanical engineers, &c. The subscribers are: W. J. Cornwell, 23, Kitto Road, New Cross, S.E.14; and W. Vanner, 5, Wilna Road, Wandsworth Common, S.W.18. Solicitor: George A. Herbert, 10, Old Square, Lincoln's Inn, W.C.2.

Sagis Products, Ltd.—Private company. Registered March 31st. Capital, £100. Objects: To carry on business as electrical engineers, electrical appliance manufacturers, heating, mechanical, constructional, marine and motor engineers, &c. The permanent directors are: R. F. May, 9, Manor Road, Potters Bar; and W. A. May, Morvena Cottage, Harestone Valley Road, Caterham.

Electrical Appliances Finance, Ltd.—Private company. Registered in Edinburgh April 2nd. Capital, £100 in £1 shares. Objects: To carry on the business of electricians, electrical or wireless engineers, lighting, heating, mechanical and general engineers, &c. The directors are: C. Edelman, 1,106, Aikenhead Road, Glasgow, and three others.

Alfred E. J. Hurst, Ltd.—Private company. Registered in Belfast March 27th. Capital, £100. Objects: To acquire the business of an electrical engineer and agent for contractors' requisites formerly carried on by the late Alfred E. J. Hurst, at College Square North, Belfast. The directors are: W. E. Hurst, 274, Antrim Road, Belfast, and two others. Registered office: 11, College Square North, Belfast.

Cawley's (1936), Ltd.—Private company. Registered March 27th. Capital, £100. Objects: To carry on the business of wireless distributors, manufacturers of all types of wireless and electrical equipment, including talking pictures and television equipment, &c. The directors are: W. Cawley, 441, Prescot Road, St. Helens, Lancs; and Miss I. Bates, 9, Studley Road, Wallasey. Secretary: Miss I. Bates. Registered office: 41, Castle Street, Liverpool.

Returns of Electrical Companies

Chubb & Colmer (1931), Ltd.—Debenture dated March 9th, 1936, to secure £200, charged on the company's property, present and future, including uncalled capital. Holder: Miss F. S. H. Milborrow, 87, Middle Lane, Crouch End, N.8.

George R. Lee & Co., Ltd.—L. Goldwyn, A.C.A., of 115, Park Street, Park Lane, W.1, was appointed receiver and manager on March 23rd, 1936, under powers contained in debenture dated March 28th, 1935.

All Wave Radio (Bristol), Ltd.—The nominal capital has been increased by the addition of £3,500 beyond the registered capital of £1,500. The additional capital is divided into 2,000 6 per cent. cumulative preference shares and 1,500 ordinary shares of £1 each.

Bondmag, Ltd.—Capital, £2,000 in £1 shares. Return dated January 13th, 1936. 1,870 shares taken up. £1,170 paid. £700 considered as paid. Mortgages and charges, £200.

Andrew, Son & Ballard, Ltd.—Capital, £200 in £1 shares. Return dated October 1st, 1935. 142 shares taken up. £1 paid. £141 considered as paid. Mortgages and charges, nil.

Sitwell Products, Ltd.—Debenture dated March 9th, 1936, to secure £1,500 charged on the company's property, present and future, including uncalled capital. Holder: John Ismay & Sons, Ltd., Roden Street Works, Ilford.

Heatly Electric Forgings, Ltd.—Satisfaction in full on March 23rd, 1936, of debentures authorised July 6th, 1933, and registered August 12th, 1933, securing £20,000.

Pulford Brothers, Ltd.—P. S. Booth, of 2, Bixteth Street, Liverpool, was appointed receiver on March 20th, 1936, under powers contained in mortgage dated April 13th, 1927.

Cherry-Burrell, Ltd.—Land Registry charge on land and factory in Power Road, Chiswick, dated February 20th, 1936, to secure all moneys due or to become due from the company to the Westminster Bank Ltd.

Solectric, Ltd.—Capital, £100 in £1 shares. Return dated December 11th, 1935. 100 shares taken up. £100 paid. Mortgages and charges, nil.

Godfrey's (Peckham), Ltd.—Capital, £500 in £1 shares. Return dated June 8th, 1935 (filed March 6th, 1936). 100 shares taken up. £100 paid. Mortgages and charges, nil.

Automatic Electrical & Mechanical Controls, Ltd.—G. F. Salas, of 15, Hanover Buildings, Thomas Street, London, W.1, was appointed receiver and/or manager on March 30th, 1936, under powers contained in debentures dated March 6th and 17th, 1936.

Robert Beresford (Newcastle, Staffs), Ltd.—Capital, £10,000 in £1 shares. Return dated December 20th, 1935. 7,000 shares taken up. £7,000 considered as paid. Mortgages and charges, nil.

Tix Products, Ltd.—Capital, £5,000 in £1 shares. Return dated December 31st, 1935 (filed March 12th, 1936). 407 shares taken up. £407 paid. Mortgages and charges, nil.

B. & E. Battery Co., Ltd.—A. J. Tray, 10, Neville Street, Newcastle-on-Tyne, was appointed receiver and manager on March 31st, 1936, under powers contained in debenture dated October 21st, 1935.

Frederick Victor, Ltd.—S. G. Crimes, 150, Southampton Row, W.C.1, was appointed receiver and manager on April 1st, 1936, under powers contained in debentures dated November 8th, 1935.

Aurolite Electrical Supplies, Ltd.—C. A. Hannam-Harris, 28/29, St. Swithin's Lane, E.C., ceased to act as receiver and/or manager on January 18th, 1936. (Notice filed March 31st, 1936.)

Britannia Electric Lamp Works (1934), Ltd.—Satisfaction to the extent of £20,000 on March 21st, 1936, of debenture dated February 16th, 1935, and registered March 1st, 1935.

Escott Bros., Ltd.—Charge on 109, Maybank Road, South Woodford, dated March 21st, 1936, to secure all moneys due or to become due from the company to Lloyds Bank, Ltd., not exceeding £1,200.

Power Installations, Ltd.—Mortgage on Tudor Works, Bradgate Street, Leicester, dated March 24th, 1936, to secure all moneys due or to become due from the company to the Midland Bank Ltd.

Permaheat Safety Cushion Co., Ltd.—Issue on March 27th, 1936, of £350 debentures, part of a series already registered.

Automatic Electrical & Mechanical Controls, Ltd.—Issue on March 17th, 1936, of £100 debentures, part of a series already registered.

British Power & Light Corporation, Ltd.—The nominal capital has been increased by the addition of £450,000 in £1 ordinary shares beyond the registered capital of £2,800,000.

Express Battery Co., Ltd.—Capital, £600 in £1 shares. Return dated December 6th, 1935. All shares taken up. £600 paid. Mortgages and charges, nil.

Electrical Equipment (Leicester), Ltd.—Capital, £4,000 in 3,500 ordinary and 500 employés' preference shares of £1. Return dated December 5th, 1935. 3,150 ordinary shares taken up. £3,150 paid. Mortgages and charges, nil.

South Beds Electrical Finance, Ltd.—Capital, £8,000 in 3,000 ordinary and 5,000 5½ per cent. redeemable preference shares of £1. Return dated January 13th, 1936. 3,000 ordinary and 1,450 preference shares taken up. £4,450 paid. Mortgages and charges, nil. Since registered: Debenture dated February 10th, 1936, to secure banking account.

Stamford Electrical, Ltd.—Capital, £20,000 in £1 shares. Return dated December 5th, 1935. 6,005 shares taken up. £6,005 paid. Mortgages and charges, £5,000. A further 1,500 ordinary shares were allotted, payable in cash and fully called up, between December 6th, 1935, and January 3rd, 1936.

F. Hulme & Co., Ltd.—Capital, £2,000 in 1,900 6 per cent. redeemable cumulative preference and 100 ordinary shares of £1. Return dated December 31st, 1935. 750 preference and 100 ordinary shares taken up. £850 paid. Mortgages and charges, nil.

Hammonds Radio, Ltd.—Capital, £1,000 in £1 shares (increased from £300 on February 18th, 1935). Returns of allotments made up to January 13th, 1936, show all shares allotted (701 for cash and 299 as fully paid). Mortgages and charges, none registered.

Radio Service (London), Ltd.—The nominal capital has been increased by the addition of £25,000 in £1 6½ per cent. cumulative preference shares beyond the registered capital of £10,000.

Rawswood Radio Corporation, Ltd.—Capital, £3,000 in £1 shares. Return dated February 21st, 1936. 1,350 shares taken up. £1,350 paid. Mortgages and charges, £500.

Aeradio, Ltd.—The nominal capital has been increased by the addition of £1,500 in £1 ordinary shares beyond the registered capital of £500.

City Notes

Johnson & Phillips, Ltd., report a profit for the year ended December 31st last of £144,720, as compared with £118,020 in the preceding year. After providing for depreciation, debenture interest, &c., and adding £101,387 brought in, there is a balance of £181,165 available. It is proposed to place £5,000 to research and development account, and to pay a final ordinary dividend of 5 per cent., making 10 per cent. for the year (against 7½ per cent.), and leaving £101,165 to be carried forward. In November last 100,000 ordinary shares were issued to shareholders at 40s. per share. The resulting premium of £100,000 has been placed to the credit of reserve account. Meeting: May 7th.

Allmänna Svenska Elektricitets Aktiebolaget (Asea), of Stockholm, reports that in 1935 production at all plants was considerably increased. To meet the growing demand the board is to extend the factories at Västeras and Ludvika. The general economic improvement in Sweden has resulted in a larger turnover in the home market, and exports also increased during the past year. The assets of the company and those subsidiaries in which the Asea holds 90 per cent. of the shares totalled at the end of 1935, 185 million Kroner (£9¼ million) as compared with 173 million Kroner in 1934. Individual results of the subsidiaries show a general improvement. The power branch A/B Skandinaviska Elektricitetsverk increased its net profit and paid a dividend of 6 per cent. The Danish subsidiary Assens Elektricitetsverk was granted a new concession for a long term of years, and the present power plant is being extended.

The Melbourne Electric Supply Co. reports a profit for the year ended August 31st last of £94,240, as compared with £81,774 in 1933-34, which, with £441 brought in, makes £94,681. The final dividend on the consolidated ordinary stock is 2 per cent., making 4 per cent., free of British tax, for the year, and £845 is carried forward. For the previous year 6½ per cent. was paid on the ordinary stock with a capital bonus of 50 per cent. During 1935 the outstanding 6½ per cent. and 7 per cent. debenture stocks, totalling £700,000, were redeemed, and the preference capital was repaid. A body of shareholders has expressed a desire that the company shall be carried on as a trust and investment concern, but the directors state that they have no wish to do so unless a substantial majority of the shareholders desire it. Steps will be taken at a later date to ascertain the views of shareholders.

The Western Union Telegraph Co., Inc., reports gross operating revenues for 1935 of $89,869,000, an increase of $2,638,000 as compared with the previous year. The net income was $5,258,000. A dividend of $2 per share has been paid. The amount appropriated for depreciation was $4,710,000. The books at the end of the year show depreciation and development reserves aggregating $41,100,000, and a general surplus of $98,500,000. At December 31st last the Western Union system comprised 215,538 miles of pole line, 4,188 miles of landline cable, 1,869,422 miles of wire, 30,325 nautical miles of ocean cable, and 20,964 telegraph offices, and in addition 15,900 telegraph agency stations.

The Electric Supply Corporation, Ltd., reports gross revenues for 1935, including interest, &c., of £107,430, as compared with £98,086 in 1934. The net revenue was £57,278, and after providing for the preference dividend and other charges, it is proposed to pay a final ordinary dividend of 7½ per cent., making 11 per cent. for the year (same). The number of consumers connected to the mains of the group at the end of the year was 14,045, an increase of 21 per cent., and the sales totalled 24,216,177 kWh, an increase of 19 per cent. Meeting: April 23rd.

The North Somerset Electric Supply Co., Ltd., reports a trading profit for 1935 of £39,614, as compared with £38,318 in the preceding year, to which is added dividends from subsidiaries, interest, and £2,499 brought in, making £44,754. The dividend on the ordinary stock is maintained at 7 per cent. and £2,703 is carried forward. The sales of electricity increased from 20,279,271 kWh to 23,500,651 kWh.

The British Engine, Boiler & Electrical Insurance Co., Ltd., in its report for 1935, states that an interim dividend of 16s. per share, less tax, was paid, and after transferring £25,000 to the pension fund there is a balance of £15,627. It is proposed to pay a final dividend of 16s. per share, less tax, and to carry forward £2,979.

Edmundson's Electricity Corporation, Ltd., reports that the results of the operations of its group of companies during March, as compared with the corresponding month of 1935, show an increase of 22 per cent. of kWh sold.

The West London & Provincial Electric and General Trust has announced a final ordinary dividend of 4½ per cent., less tax, making 6 per cent. for the year (against 5 per cent.).

Babcock & Wilcox, Ltd., have declared a final dividend of 4 per cent., less tax, maintaining the distribution for the year at 8 per cent.

Stocks and Shares

TUESDAY EVENING.

STOCK Exchange business after the Easter holidays was of that rather indeterminate character that requires a few days to enable it to settle down into any kind of defined stride. Orders came spasmodically. The dominating factors that outweigh every other consideration are the ceaseless accumulation of capital and, its necessary concomitant, the urgent necessity of finding profitable employment for this money. Against these factors, the re-entry of summer-time is of no more consequence than its immediate follower, the opening of the Budget. Prices are firm in most of the Stock Exchange markets. Gilt-edged issues are strong.

Electricity Supply Shares

Apart from a quiet demand for Midland County shares, which lifted the price 1s. to 41s., the electricity supply market lacks interest and incident. Northamptons at 55s. and Llanellys at 25s. 3d. are both a little better. Hendons at 54s. 3d. are on the easy side. Among the shares of companies operating abroad, Calcuttas and East Africans are higher at 62s. 3d. and 34s. respectively. Palestine "A" improved 6d. to 52s. 6d. and Perak Hydros are maintained at 25s. 9d. Tokyo "sixes" receded a point further to 82.

Callenders and Henleys

Callenders have risen 5s. to 87s. 6d. upon the execution of two buying orders that reached the market at about the same time, and ran into several thousands of shares. It is not known whether the purchasers have concluded their investment in Callenders, but the price of the shares maintains the full extent of the rise. Sir Tom Callender's many messages of congratulation upon his birthday last week included wires from Stock Exchange members and friends who hope that he will go to par.

Henleys have come to market from a quarter that suggests American selling. Three thousand shares could have been bought in a line at 145s. 6d. or thereabouts. A third of the parcel was taken, and no difficulty is likely to be experienced in finding a home for the other 2,000 shares. Henleys have paid 30 per cent. on the ordinary shares for seven successive years. The final dividend for the past year is due for declaration next month.

Manufacturing and Equipment

The strength of cable manufacturing companies' shares is the feature of a firm electrical equipment market. Henleys, and the rise in Callenders are discussed above. Steady buying of Enfields brought to light a dearth of shares in the market and forced up the price from 5 to 5⅛. British Insulated joined in the movement, rising ⅛ to 5¼. Johnson and Phillips did not respond to the company's report of higher profits. The dividend of 10 per cent. for the year is 2½ per cent. up—a very satisfactory increase.

Cable shares are far from monopolising public interest in this market. Crompton Parkinsons are quoted at 65s., against 62s. 6d. last week. Electric Constructions also rose ⅛ to 1⅞. Telegraph Condensers are firm: at 2⅜ the shares are 7/16 higher than they were a fortnight ago. Lancashire Dynamos gained 1/16 to 43s., and Reyrolles 9d. to 68s. Leading telephone manufacturing shares display strength. Ericssons have risen 1/16 to 2¼, International Automatic ordinary 2s. to 45s., and the deferred 1s. 6d. to 44s. Halls are 21s. Chloride Electrical Storage are steady at their higher level of 93s. 9d. Babcock and Wilcox fell half a crown to 52s. 6d. There is disappointment that the 8 per cent. dividend just declared is not larger than the previous year's distribution. British Aluminiums and Associated Electricals shed a few pence, but General Electrics are steady. English Electric ordinary lost 6d. to 20s. 6d. and the preference gained a like amount to 26s.

Telegraphs and Others

Cable and Wireless stocks continue to be well supported on hopes of an early arrangement for dealing with the accumulation of dividend arrears. The preference is another point higher at 111, while the "A" and "B" stocks are maintained at 29 and 8 respectively. Globe Telegraphs issues are sympathetically higher; the ordinary at 16½ and the preference at 14⅛ each improved by ⅛. Western Unions, at 88, have lost 2 points of last week's big rise, and Radio Corporations fell from 13¼ to 12¾. International "Tel. and Tel." are easier at 16¼, a fall of ⅛. American "Tel. and Tel." failed to hold a rise of 2¼ points and are unchanged on balance at 167½. Great Northerns advanced to 45.

Hydro Electrics and International Holdings are weak on the former company's announcement of a reduction in income. Hydros lost ¼ to 8¾ and Holdings 1/16 to 2. Tillings and B.E.T.'s are unchanged.

Among new-comers, Newman Industries 2s. shares are being dealt in around 3s. 3d.; the 5s. preferred are 5s. 3d. Pressed Steel 5s. ordinary, which were offered at 22s. 6d., opened at 24s. 3d., and eased later to 23s. 9d. Revo Electrics are a small fraction better at 39s. 9d.

Prices and Precision

The quotations in our weekly price-lists are taken from the Lists officially compiled by the Stock Exchange, and published under the authority of the Stock Exchange Committee. Altogether, there are forty columns, closely printed, in this List alone: the Supplementary List contains a further thirty-two columns. As a rule, these official prices are reasonably correct. Criticism can argue with justice that the margins between buying and selling are unduly wide in many cases. This is a point to which the attention of the newly elected Stock Exchange Committee might be turned as a matter of public interest. That the Committee is ready to take such hints is evidenced by the prompt way in which the margin of 3s. 9d. per share was narrowed to 2s. per share in the case of Electricity Supply ordinary, when the desirability of such a change was indicated. The need for a more exact measure of accuracy might be investigated by the Committee at the same time.

Share List of Electrical Companies

Home Electricity Companies.

	Nom.	Dividend. 1933.	Dividend. 1934.	Price April 14.	Rise or Fall.	Yield p.c. £ s. d.
Bournemouth and Poole	1	15	15	77/–	—	3 18 0
City of London	1	7½	7½	37/6	—	4 0 0
Clyde Valley	1	7	8	45/6	—	3 10 4
County of London	1	10½	10½	57/–	—	3 13 8
Edmundson's 7% Pref.	1	7	7	36/–	—	3 17 9
Do. Ord.	1	7	8	45/–	—	3 11 1
Elec. Dis. Yorkshire	1	9	9	47/–	—	3 16 7
Elec. Fin. and Securities	1	12½	12½	3 7/8	—	3 12 9
Elec. Supply Corporation	1	11	11	65/9	—	3 7 0
Lancs Light and Power	1	7½	7½	39/–	—	3 17 0
Lond. Assoc. Electric	1	—	—	34/–	—	4 2 4
London Electric	1	7	8	40/–	—	4 0 0
London Power Deb. Red.	Stock	5	5	107½	—	4 13 0
Metropolitan	1	10	10	52/–	—	3 17 0
Midland Counties	1	7	7½	41/–	+1/–	3 13 2
Mid. Elec. Power	1	8	8	41/3	—	3 17 7
North Eastern Electric Ordinary	1	6	6	33/6	—	3 11 8
Do. 7% Pref.	1	7	7	34/6	—	4 1 2
Northampton	1	10	10	55/–	+9d.	3 12 9
Notting Hill 6% Pref.	10	6	6	14½	—	4 2 9
North Met. Elec. Ordinary	1	10	10	3	—	3 6 8
Do. do. 6% Pref.	1	6	6	32/–	—	3 15 0
Scottish Power	1	8	8	42/–	—	3 16 2
South London	1	7	7	34/6	—	4 1 2
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	25/6	—	5 17 8
Yorkshire Elec.	1	8	8	46/–	—	3 9 7

Public Boards.

Central Electricity, 1950–70	Stock	5	5	116½	—	4 4 10
Do. 1955–75	,,	5	5	119	—	4 4 0
Do. 1951–73	,,	4½	4½	112	—	4 0 4
Do. 1963–93	,,	—	3½	103	—	3 8 0
London Elec. Trans. Gtd.	,,	—	2½	97	—	2 11 7
London & Home Counties, 1955–75	,,	4½	4½	112	—	4 0 4
London Passenger Transport, A.	,,	—	4½	124½	—	3 12 4
Do. do. B.	,,	—	5	127	—	3 18 9
Do. do. C.	,,	3½	4	105	—	3 16 2
West Midlands Joint Elec. 1948–68	,,	—	5	116½	—	4 5 10

Telegraph and Telephone.

American Tel. & Tel.	$100	9	9	167½	—	5 7 6
Anglo-Am. Tel. Pref.	Stock	6	6	123½	—	4 17 2
Do. Def.	,,	1½	1½	29	—	5 3 5
Cable & Wireless 5½% Pref.	,,	2¾	4½	111	+1	3 14 4
Do. A. 7½% Ord.	,,	Nil	Nil	29	—	—
Do. B. Ord.	,,	Nil	Nil	8	—	—
Globe Tel. & Tel. Ord.	10	2½	3½*	16½	+⅛	2 3 4
Do. do. Pref.	10	6	6	14⅛	+⅛	4 5 0
Great Northern Tel.	10	20	20	45	+1	4 9 0
Marconi-Marine	1	10	7½	33/9	—	4 9 0
Oriental Telephone Ord.	1	12	12	3½	—	3 13 10

Home and Foreign Trams, etc.

Anglo-Arg. Trams First Pref.	5	Nil	Nil	1/–	—	—
Do. do. 2nd Pref.	5	Nil	Nil	9d.	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	5	—	—
British Electric Traction Df. Ord.	,,	5	5	1600	—	—
Do. do. Pref. Ord.	,,	8	8	179½	—	4 19 2
Brazil Traction	100	—	—	12½	—¾	—
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	100½	—	4 19 6
Mexican Light Common	100	Nil	Nil	4½	—	—
Do. 7% Pref.	100	7	7	6½	—	—
Do. 1st Bonds	$500	5	5	57½	—	—
Victoria Falls Ord.	1	20	20	77/6	—	—
West Riding	1	5	6½	52/6	—	2 9 6

Manufacturing Companies.

Aron Electricity Ord.	1	10	15	66/3	—	4 10 7
Assoc. Elec. Ord.	1	6	8	47/6	—6d.	3 7 4
Do. Pref.	1	8	8	39/–	+6d.	4 2 1
Babcock & Wilcox	1	6	8	52/6	—½	3 1 0
British Aluminium Ord.	1	5	7½	41/0	—6d.	3 13 2
British Insulated Ord.	1	15	20	5½	+½	3 16 1
Brush Ord.	Stock	Nil	Nil	42½	—	—
Callender's	1	15	15	4½	+½	3 8 2
Do. 6½% Pref.	1	6½	6½	31/3	—	4 3 2
Crompton Parkinson Ord.	5/–	—	12½	65/–	+½	0 19 3
Do. 8% Pref.	1	8	8	38/9	—	4 2 7
Edison Swan 1st Pref.	1	7½	7½	30/–	—	5 0 0
Electric Construction	1	Nil	3½	1⅞	+⅛	1 17 4
Enfield Cable Ord.	1	25	25	5⅛	+⅛	4 13 0
English Electric	1	Nil	Nil	20/6	—6d.	—
Do. do. Pref.	1	Nil	Nil	26/–	+6d.	—
Ericsson Tel.	5/–	24	20*	2¼	+1/16	2 4 6
Ever Ready	5/–	35	35	24/9	+6d.	7 1 5
Ferranti Pref.	1	7	7	26/9	—	5 4 8
G.E.C. Pref.	1	6½	6½	34/–	—	3 16 6
Do. Ord.	1	8	10	79/6	—	2 10 4
Henleys	1	30	30	7⅛	—	4 2 9
Do. 4½% Pref.	5	4½	4½	5⅛	—	3 18 3
India-Rubber Preferred	1	—	5½	1½	—	4 17 9
Johnson & Phillips	1	7½	10	46/9	—	4 5 7
Siemens Ord.	1	6½	4	27/6	—	2 18 2
Telegraph Construction	£1	Nil	Nil	27/6	—	—

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1934

17845. "Electronic tube with anode current control." Radio Akt.-Ges. D. S. Loewe. June 17th, 1933. (444471.)

20434. "Cathode-ray oscillographs with internal electrodes." R. A. W. Watt and L. H. Bainbridge-Bell. July 12th, 1934. (444173.)

20959. "Wireless and like receivers." F. T. Lett. July 17th, 1934. (444391.)

21208. "Radio transmission arrangement, more particularly for short or ultra-short wave purposes." Radio Akt.-Ges. D. S. Loewe. July 21st, 1933. (Addition to 435561.) (444474.)

23312. "Position-indicating devices applicable to wireless tuning members." Regentone, Ltd., and H. A. Brooke. August 13th, 1934. (444240.)

23331. "Electric-arc lamps." A. Stahn. August 19th, 1933. (444241.)

23591. "Wireless and like receivers." C. S. Agate and W. S. Percival. August 15th, 1934. (444177.)

23595. "Thermionic-valve arrangements." Marconi's Wireless Telegraph Co., Ltd., and N. M. Rust. August 15th, 1934. (444178.)

23703. "Wireless receiving apparatus." F. T. Lett. August 16th, 1934. (444179.)

23872. "Wireless receiver for operating clocks and watches." J. E. Purser. August 18th, 1934. (444316.)

26192. "Electric clocks." A. C. Krause. September 12th, 1934. (444243.)

26421. "Electric starter control systems for internal-combustion engines." Eclipse Machine Co. September 15th, 1933. (444190.)

26460. "Navigation aiding wireless systems." Telefunken Ges. für Drahtlose Telegraphie. October 11th, 1933. (444194.)

26477. "Electrical heating appliances, particularly intended for heating liquids." D. W. Rudorff. September 14th, 1934. (444196.)

26491. "Temperature-sensitive electric switches." M. Payne and British Thermostat Co., Ltd. September 14th, 1934. (444248.)

26546. "Electric heaters." W. J. Worthington. September 15th, 1934. (444200.)

26551. "Systems and apparatus for obviating disturbances in radio receivers by the ignition systems of nearby internal-combustion engines." Marconi's Wireless Telegraph Co., Ltd., and A. A. Linsell. September 15th, 1934. (444201.)

26703. "Apparatus for electric forging." G. Benedetto and Omes, Ltd. September 17th, 1934. (Addition to 352509.) (444396.)

26705. "Telephone systems." Automatic Electric Co., Ltd., O. A. Pearce and I. T. Richards. September 17th, 1934. (444256.)

26934. "Fault-detecting and cutting-out systems for electric supply circuits." British Thomson-Houston Co., Ltd., F. E. Butler and D. E. Jewitt. September 19th, 1934. (444399.)

26935. "Gaseous electric-discharge devices." British Thomson-Houston Co., Ltd., and H. R. Ruff. September 19th, 1934. (444400.)

26967. "Receivers for modulated carrier wave signals." J. Robinson. September 19th, 1934. (444402.)

27047. "Electrode holder for use in arc welding." E. J. Clarke and Murex Welding Processes, Ltd. September 20th, 1934. (444489.)

27054. "Electric coupling arrangements for vacuum cleaners and other electrically driven apparatus." Electrolux, Ltd. October 2nd, 1933. (444406.)

27119. "Aerial systems for wireless reception transmission." L. A. Chapman. September 20th, 1934. (444494.)

27264. "Terminations and joints for electric cables." Enfield Cable Works, Ltd., A. Bowden and E. Bowden (legal representatives of E. Bowden, dec.), and S. Chaplin. September 22nd, 1934. (444408.)

27358. "Tone-correction circuits." Pye Radio, Ltd., and C. J. Carter. September 24th, 1934. (444261.)

27386. "Thermionic valves." M-O Valve Co., Ltd., and M. Benjamin. September 24th, 1934. (444263.)

28582. "Air-break electric switch fuses." British Thomson-Houston Co., Ltd. October 5th, 1934. (Convention date not granted.) (444410.)

28784. "Means for protecting the motor-generator sets employed in winding equipments and the like against over-speeding." British Thomson-Houston Co., Ltd., and R. D. Given. October 8th, 1934. (444269.)

28989. "Synchronisation of electric machines." M. K. Taylor and Ferranti, Ltd. October 10th, 1934. (Cognate application 37239/34.) (444270.)

29613. "Electric fires." F. H. Smith. October 16th. 1934. (Cognate applications 32141/34, 36986/34, 1391/35.) (444412.)

31172. "Contact members for switches." C. H. Parsons, Ltd., and G. B. Handley. October 31st, 1934. (444272.)

31361. "Electrostatic precipitation of suspended matter from gas." Sturtevant Engineering Co., Ltd., and H. W. Wagner. November 1st, 1934. (444333.)

31584. "Electric lampholders." J. A. Crabtree. November 3rd, 1934. (Addition to 405023.) (444211.)

31869. "Audible electric signalling devices." Siemens Bros. & Co., Ltd., and C. R. Riber. November 6th. 1934. (444415.)

31915. "Thermionic valves." S. P. De László. November 6th. 1934. (444416.)

31935. "Sparking plugs." T. E. Moore. November 7th, 1934. (444336.)

32744. "Thermionic valve testing devices." General Electric Co., Ltd., and W. Sanders. November 14th, 1934. (444341.)

34057. "Means for controlling the temperature of bodies, such as electrically energised heating devices." General Electric Co., Ltd., and O. W. Humphreys. November 27th, 1934. (444344.)

34223. "Protective arrangements for electric power-transmission systems." General Electric Co., Ltd., W. Wilson and J. S. Cliff. November 28th, 1934. (444418.)

35318. "Miners' and like battery hand lamps." Batteries, Ltd., and M. Dybeck. December 8th, 1934. (444347.)

37005. "Electronic-discharge vessels." Siemens & Halske Akt.-Ges. December 22nd, 1933. (444424.)

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1339. "Rapping mechanism used in the electrostatic precipitation of particles from gas." Sturtevant Engineering Co., Ltd. (Soc. Purification Industrielle des Gaz). January 15th, 1935. (444426.)

5337. "Television and like systems." G. E. G. Graham and Baird Television, Ltd. February 19th, 1935. (444360.)

7946. "Electric-discharge devices." British Thomson-Houston Co., Ltd. March 17th, 1934. (444362.)

10555. "Actuating devices for electric switches." F. Thomas. April 5th, 1935. (444438.)

11362. "Sparking plug with renewable electrodes for internal-combustion engines." M. O'Marra. August 11th, 1934. (444439.)

12828. "Electric tumbler switches." R. Bain and N. Allday. April 30th, 1935. (444444.)

13299. "Method and apparatus for the production of electric contacts." Siemens & Halske Akt.-Ges. May 3rd, 1934. (444445.)

14214. "Electrolytic condensers." Plessey Co., Ltd. May 15th, 1934. (444231.)

14215. "Electric circuit altering devices." P. R. Mallory & Co., Inc. October 23rd, 1934. (444370.)

13450. "Method of carrying out chemical reactions by means of electric discharges." British Thomson-Houston Co., Ltd. June 28th, 1934. (444526.)

18634. "Protective devices for electric circuits." British Thomson-Houston Co., Ltd. June 30th, 1934. (444374.)

19133. "Electric lighting installations." Compagnie Française Auxiliaire des Mines. July 6th, 1934. (444234.)

20416. "Electrical rectifiers." Westinghouse Brake & Signal Co., Ltd. February 14th, 1935. (444236.)

20777. "Impulse generators employing electric-discharge devices." British Thomson-Houston Co., Ltd. July 21st, 1934. (444454.)

22067. "Sewing-machine lighting device." Singer Manufacturing Co. May 9th, 1935. (444538.)

22930. "X-ray apparatus." British Thomson-Houston Co., Ltd. August 18th, 1934. (444293.)

23948. "Apparatus for the electrical treatment of gaseous fluids." Lodge-Cottrell, Ltd. (Research Corporation of New York). August 27th, 1935. (444459.)

23989. "Electrolytic condensers." Dubilier Condenser Co. (1925), Ltd. October 1st, 1934. (444542.)

24078. "Electrical resistance devices." British Thomson-Houston Co., Ltd. August 30th, 1934. (444381.)

24484. "Electric-discharge devices." British Thomson-Houston Co., Ltd. September 1st, 1934. (444384.)

25561. "Electric-discharge lamps." British Thomson-Houston Co., Ltd., and General Electric Co., Ltd. September 15th, 1934. (444545.)

27457. "Electric-discharge devices." British Thomson-Houston Co., Ltd. October 4th, 1934. (444547.)

28471. "Electric-remote control systems." British Thomson-Houston Co., Ltd. October 16th, 1934. (444297.)

29190. "Magnetic testing apparatus." Allgemeine Elektricitäts Ges. October 22nd, 1934. (444299.)

29761. "Electroplating baths." Schering-Kahlbaum Akt.-Ges. October 26th, 1934. (444464.)

30262. "Electric transformers." British Thomson-Houston Co., Ltd. November 1st, 1934. (444301.)

30724. "Clamps for electric trolley wires." J. Hahn and G. Rieckeheer. November 6th, 1935. (444466.)

31881. "Circuit arrangements comprising a gasfilled discharge tube." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. December 13th, 1934. (443307.)

35373. "Vacuum electric-discharge apparatus." British Thomson-Houston Co., Ltd. December 29th, 1934. (444313.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from April 8th :—

Coldspot (lettering and design). No. 566337. Class 6. Refrigerating machines.—Searsint, Ltd., Thames House, Millbank, Westminster, S.W.1.

Gramoradio (lettering and design). No. 566022. Class 8. Sound reproducing and recording apparatus, wireless telephonic apparatus, television apparatus, wireless telephonic apparatus in combination with gramophones and parts thereof. —Radio Gramophones & Television, Ltd., 22, Soho Square, W.1.

Standards for Flexible Cords

The British Standards Institution has just issued revised tables for the make-up of flexible cords. Up to the present their construction has been governed by Tables 4 and 4A in B.S. Specification No. 7, the diameter of the individual strands being 0.012 in. In the revised tables the strand diameter has been changed to 0.0076 in. and the number of strands has been modified accordingly. Copies of the revised tables (under reference CD (EL) 9593) will be forwarded gratis by the Publications Department, British Standards Institution, 28, Victoria Street, London, S.W.1.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Alnwick.—Houses (90), St. Thomas Close estate; U.D.C. surveyor.

Amesbury.—Hotel, Highpost aerodrome; Doran Webb, architect.

Ashton-under-Lyne.—Houses, A2 and A3 type, Hirst Mill, Queen's Road and King's Road; James Ridyard & Sons, Ltd., builders, Railway Saw Mills, Ashton-under-Lyne.

Bedfont (MIDDLESEX).—Factory for Minimax, Ltd., 18, Broadway Buildings, Westminster, London, S.W.1.

Bideford.—Cinema, High Street (electrical work); Coastlands, Ltd., Ilfracombe.

Birmingham.—Offices and shops, Broad Street, for the Odeon Theatres, Ltd.

Blackpool.—Library and clinic, Bispham; borough surveyor.

Bridgnorth.—Houses (20), Highley; Geoffrey Phillips, architect.

Bristol.—Houses (70), Southmead estate; city engineer, 51, Prince Street, Bristol.

Buckinghamshire.—Two schools, Aylesbury, for County E.C.

Cambridge.—Houses (100), Old Chesterton, for the Hundred Houses Society, Ltd.; C. W. Craske, architect.

Cardiff.—Girls' school, Colchester Avenue; director of education.

Carlisle.—Houses (126), Petteril Bank, and Fusehill (62); city engineer. Methodist church, Currock Road; J. S. Stout. Extensions to library; J. Laing & Son, Ltd.

Chatham.—Four senior schools, for Borough E.C.; R. L. Honey, borough surveyor.

Chesterfield.—Houses (26), Baden Powell Road; Clark Bros., builders, Baden Powell Road, Chesterfield.

Chester-le-Street.—Houses, Chilton Moor estate and Hetton Road; V. J. Hunter, surveyor.

Colne (LANCASHIRE).—Houses (66), Cook House estate; borough surveyor.

Congleton.—Houses (24), Bromley Road (electrical work); borough surveyor. Elementary school, Waggs Road (£20,572), for E.C.

Crewe.—Covered baths, Flag Lane (£40,000); Leonard Reeves, borough engineer.

Dagenham.—Municipal offices (£81,196); Allen Fairhead & Sons, Ltd., builders, Enfield.

Devonshire.—Girls' secondary school, Shiphay Lane, Torquay, for County E.C.

Dewsbury.—Houses (372); borough architect.

Dunfermline.—Arcade, High Street; Claude Alexander & Co., 113, Brook Street, Bridgeton, Glasgow.

Ealing.—Schools, North Hanwell and Perivale, for E.C.

Edinburgh.—Aerodrome and school, Stenhouse (£57,000); city architect.

Evesham.—Senior schools (320 places), for the Church of England managers; secretary.

Eyemouth.—Houses (32), electrical work; burgh surveyor.

Filey.—Houses (£26,722); U.D.C. surveyor.

Gateshead-on-Tyne.—Houses (70), Old Ford Road; F. H. Patterson, borough engineer.

Gloucestershire.—Senior schools, Dursley; director of education, Gloucester.

Golborne (LANCASHIRE).—Houses (91), Heath Lane, for W. Moores.

Guildford.—Houses (50), Dennisville; Dennis Bros.

Halesowen.—Houses (62), Cradley; W. J. Tolley, builder, Houses (120), Red Leasowes estate; J. Harper & Sons, builders, Blackheath, Birmingham.

Harrow.—Cinema, Alexandra Avenue; F. E. Bromige, architect.

Hertfordshire.—School, Buntingford; director of education, Hertford.

Highworth (WILTSHIRE).—Houses (20), Upper Stratton; R. J. Beswick & Son, architects, 10, Victoria Road, Swindon.

High Wycombe.—Church, Holmer Green, for the Methodist trustees; secretary.

Hinckley.—Premises, Charwood Road, for the Barwell & District Co-operative Society, Ltd.

Hyde.—Extensions to works, Gt. Norbury Street; Norbury Engineering Co. Extensions to works, Mary Street; Watkin & Co.

Ilkeston.—Houses (98), near Richmond Avenue; D. Clegg & Co. Bus depot, Manor Road; Barton Transport, Ltd.

Inverness.—Dance and concert hall, Huntly Street, for John Henderson, 28, High Street.

Knottingley.—Houses (76), Broomhill; G. J. Laverick, U.D.C. surveyor.

Leeds.—Rebuilding stores, for Lewis's, Ltd., Liverpool.

Leicester.—Cinema, for the Associated British Cinemas, Ltd., 30, Golden Square, London, W.1. Elementary school, Shaftesbury Road (£20,000), for E.C.

Lewes.—School (640 places), Mountfield Road; director of education.

Lincoln.—Baths, Brayford and Boultham; S. C. Baggott, city surveyor.

Lichfield.—Rebuilding, 26, Market Street; F. Pope.

Littlehampton.—Houses (28), Horsham Road site; U.D.C. surveyor.

Liverpool.—Extensions to works, for Elexcel, Ltd., Broadgreen.

London.—(W.1).—Block of flats, Portland Place; E. A. Stone & Partners, 20, Berkeley Street, W.1. (WILLESDEN).—Extension to factory for B.E.N. Patents, Ltd.

Market Harborough.—Extensions to Caxton works; Tungstone Accumulator Co., Ltd.

Marlow (BUCKINGHAMSHIRE).—Cinema, electrical work, for the County Cinemas, Ltd.; proprietors of King George's Cinema.

Mirfield (YORKSHIRE).—Houses (154), Sunnybank Road, for A. & F. Mellor, Shipley.

Nantwich.—Houses (34); R.D.C. surveyor.

Nelson (LANCASHIRE).—Houses (24) and bungalows; borough surveyor.

Newcastle (STAFFORDSHIRE).—Houses (50), Clayton; Watkin & Maddox, architects, 15, High Street, Newcastle.

Newcastle-on-Tyne.—Church, Benwell Grove, for the vicar and wardens of Benwell Church; E. Edwards, architect, Armstrong College, Newcastle-on-Tyne. Hospital, Westgate Road, for C.C.; R. G. Roberts, city architect, 13, Cloth Market. Large engineering shop, Scotswood Road, for Vickers Armstrong, Ltd. News-reel cinema, Northumberland Street, for Louis Bertorelli; J. N. Fatkin, architect, 17, Bigg Market. Relief station, Bentinck Road, for C.C.; J. F. C. Solomon, city property surveyor. School, Cragside, for E.C.; A. K. Tasker, architect, Trinity Buildings, New Bridge Street, Newcastle-on-Tyne.

Newport (SHROPSHIRE).—Bank premises, High Street, for the National Provincial Bank, Ltd., 15, Bishopsgate, London, E.C.2; John Carver, builder, Victoria Avenue, Wellington, Shropshire.

Newport (I.o.W.).—Office and store, Quay Street; Whitbread & Co., Ltd.

Nottingham.—Baths, Bullwell and Sherwood (£39,000); city engineer.

Penistone (YORKSHIRE).—Houses (34), Silkstone; R.D.C surveyor.

Perth.—Grass drying factory, Perth Aerodrome, for the Grass Products, Ltd.

Pewsey (WILTSHIRE).—Houses (24); R.D.C. surveyor.

Radlett (HERTFORDSHIRE).—Church, for the Methodist trustees; secretary.

Redditch.—Houses (30), Beoley estate; H. A. Bright. Estate development of Prospect Hill; Redditch Land Development, Ltd.

Rotherham.—Houses, Blackburn Lane; J. R. Jubb. Fire station (£37,050); borough engineer. Extensions to works, Grange Mill Lane; A. Shardlow & Co., Ltd.

Rugby.—Houses (22), Croop Hill; borough surveyor.

St. Albans.—School (£36,953), for City E.C.; Mauger & May, architects.

Saddleworth.—Houses (32); U.D.C. surveyor. Houses (32), Ainley Wood estate, Delph, for the Delph Co-operative Society, Ltd.; secretary.

Scarborough.—Houses, near Wheatcroft Avenue, for the trustees of the late W. Tindall; J. Petch & Sons, architects, 12, Valley Bridge Parade, Scarborough.

Selkirkshire.—School, Glendinning Terrace, Galashiels, for County E.C.

Shropshire.—Extensions to Oswestry Girls' High School, for County E.C.

Sidmouth.—Houses (144), Manstone estate; Unwin & Son, builders, Bournemouth.

Southampton.—Extensions to Itchen Secondary school (£29,204); director of education.

Southport.—Houses, Carr Lane; W. Morris & Bros., Ltd.

Spenborough (YORKSHIRE).—Houses (72), Hightown; U.D.C. surveyor.

Stafford.—Wing to Staffordshire General Infirmary (£23,362); Wm. Sharratt, Ltd., builders, Wolverhampton.

Staffordshire.—Senior school, Uttoxeter; director of education, Stafford.

Staveley.—Houses (44) and bungalows; U.D.C. surveyor.

Stonehaven.—Cinema for the Queen's Cinema Co.; the manager.

Stourbridge.—Houses (68), Wollaston; borough surveyor.

Stretford.—Factory, Westinghouse Road; Southern Oil Co., Ltd.

Sunderland.—Additions to furniture factory, Low Row, for W. Winberg; S. J. Stephenson & Gillis, architects, 2, Saville Place, Newcastle-on-Tyne.

Tamworth.—Houses (51); R.D.C. surveyor.

Torquay.—Houses (72), Old Woods estate; Western Counties Brick Co., Ltd.

Wakefield.—Shops and offices, Kirkgate; Prices, Tailors, Ltd. Extensions to Albion Mills, Ings Road; F. W. Moore.

Wallsend-on-Tyne.—Houses (50), land near Station Road; borough engineer.

Ware (HERTFORDSHIRE).—Houses (48); R.D.C. surveyor.

Warrington.—Houses, Chester Road; Woosey & Walton. Church, St. Augustine's Avenue; R.C. Diocesan trustees. Shrewsbury. Extensions to foundry, Stafford Road; Ferrous Light Castings, Ltd.

Wellingborough.—Houses (28) and bungalows, Brook Farm estate; T. Giles.

Wellington (SHROPSHIRE).—Cinema, Priory estate, fronting Holyhead Road and New Church Road; A. Noel Procter, civil engineer, 113½, Edmund Street, Birmingham.

West Riding.—Senior school (£20,000), Penistone, for County E.C.; education architect, Wakefield.

Wigan.—Houses, Worsley Hall Farm (77½ acres); borough surveyor.

Worthing.—Houses (128), Jupps Lane, for the Chatsmore Estates, Ltd.; Wignall & Ainsworth. Houses (69), Mansfield Close; H. M. Potter, architect. Cinema, Findon Road; A. T. W. Goldsmith, architect. Development of Sompting estate; Adams, Thompson & Fry, architects. Estate development of South Farm Road, for the Centrecourt Investment Co., Ltd.; E. J. Love, architect. Extensions to Swandean Hospital (£23,256); W. A. Tree.